1990 HIGH SEAS SQUID

DRIFTNET FISHERY

Manual for Observers

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1.0 INTRODUCTION

1.1 OVERVIEW

Several events precipitated the development of new high seas driftnet fisheries in the North Pacific Ocean in the late 1970's. First, the price of fuel increased during the 1970's to the extent that fishing techniques like driftnetting which do not require extensive daily travel and fuel consumption became more economically attractive. Second, led by Peru and Ecuador, coastal nations of the world adopted exclusive economic zones to 200 miles offshore, forcing many distant-water fleets to develop new high seas fisheries. Third, falling tuna prices in the late 1970's stimulated tuna longline vessels to explore other fishing opportunities. Fourth, reduction of salmon fishing areas available to driftnet fleets as a result of the passage of the U.S. Magnuson Fisheries Conservation and Management Act in 1976, closure of the U.S.S.R. 200 mile zone in 1977, amendments to the International Convention for the High Seas Fisheries of the North Pacific Ocean in 1978 and 1986, and decreased Japanese salmon quotas by the Soviet Union idled many driftnet vessels.

Displaced from salmon fishing in the late 1970's and early 1980's, many of the Japanese salmon driftnet vessels moved south to target on the flying squid, Ommastrephes bartrami. When not involved in other fisheries, other vessels also entered the high seas squid driftnet fishery. These fleets operate outside of the jurisdiction of any national (other than domestic) or international management regime. Since the early 1980's, the Japanese fleet has stabilized at about 500 high seas squid driftnet vessels operating 4-7 months per year. The ROK and Taiwan have also developed driftnet fleets of about 100-150 vessels each, which are known to fish for flying squid.

In the United States, in 1987 Congress passed the "Driftnet Impact Monitoring, Assessment, and Control Act." This act required the Secretary of Commerce, through the Secretary of State, to initiate negotiations with nations that conduct driftnet fishing that "results in the taking of marine resources of the United States in waters of the North Pacific Ocean outside the exclusive economic zone of any nation." The purpose of the negotiations was to develop a cooperative agreement for the monitoring and assessment of the numbers of marine resources of the United States killed and retrieved, discarded, or lost in driftnet fisheries.

In Canada the potential interception of Canadian origin salmon and steelhead in the driftnet fisheries stimulated a great deal of interest. In 1987, Canada was the first nation to ban driftnet fishing after documenting the wasteful nature of driftnet fishing during experimental fisheries in the Canadian 200 mile zone.

In 1989, reacting to growing international concern, Japan agreed to allow American and Canadian observers on commercial driftnet vessels. The agreement outlined a process for collecting and handling the data.

1.2 NORTH PACIFIC SQUID DRIFTNET FISHERIES

1.2.1 Japan

Financial losses by Japanese squid jigging vessels and high catch rates by the growing fleet of squid driftnetters, led in 1981 to the establishment of a limited-entry system as well as time/area regulatory measures. These regulations established a 7-month fishing season extending from June through December, and a northern boundary that changed monthly over the fishing season to minimize the incidental catch of salmonids. Two permits for vessels between 50 and 500 GT were issued; one allowing 7 months of operations from 1 June to 31 December and the other allowing 4 months of operations from 1 August to 30 November.

According to Japanese reports in 1987, a total of 29,613 driftnet operations were conducted in the Japanese North Pacific squid driftnet fishery, a 10% decrease from 1982. The number of licensed vessels has declined by approximately 7% since 1982 to 478 licensed vessels in 1987. However, there have been yearly increases in the percentage of large vessels participating in the fishery. Larger vessels deploy more gear, are able to fish in rougher weather, and have greater endurance, all of which results in greater fishing effort per vessel. Information on the total amount of gear used or the amount of gear used by vessel type is not available.

1.2.2 The Republic of Korea

The ROK high seas driftnet vessels first began harvesting flying squid in 1979. Although fishing grounds were initially located in the western North Pacific, the fishery soon extended eastward reaching 160°W by 1983. The number of registered vessels grew from 14 in 1980 to 99 by 1983 and approximately 130 in 1987. The ROK has recently developed domestic regulations prohibiting the retention of salmonids and marine mammals by squid driftnet vessels, and has implemented time/area restrictions for this fishery.

Each year, the ROK fishery begins in late April, starting around 35°N and 165°E. The vessels quickly move eastward to as far as 165°W by July, concentrating fishing effort east of 170°E. In early fall, the vessels move westward, fishing near the coast of Japan at the season's end in January. In late spring and summer, the fishery targets on the large size-group of flying squid. By fall and early winter, the fishery operates west of 170°E, targeting on squid that have grown to a harvestable size and are caught in smaller mesh size driftnets.

1.2.3 The Republic of China

The Taiwanese driftnet fishery began with 12 vessels in 1980, growing to almost 150 vessels by 1984. In 1988, there were 165 driftnet vessels. Although fishing grounds were initially located in the western North Pacific, the fishery expanded eastward reaching 160°W by 1983. Fishing has generally occurred from May through October with peak effort in August and September.

Due to concerns by the United States about the incidental harvest of salmonids, Taiwan adopted domestic regulations for squid drifnetters in 1985. In waters west of 170°E, fishing is prohibited north of 39°N. Regulations similar to Japanese domestic regulations were adopted for waters east of 170°E.

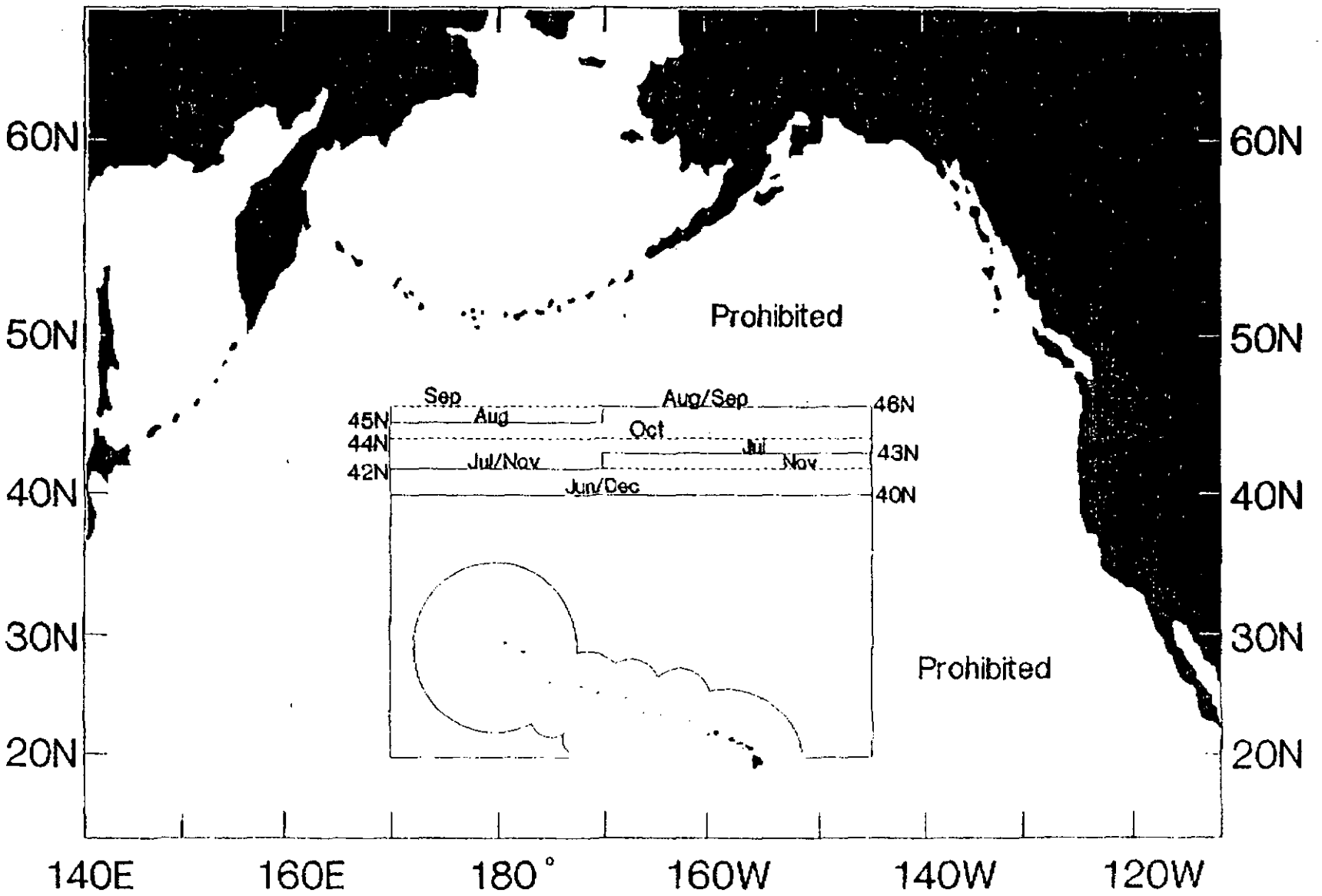


Figure 1-1.-- 1990 Japanese high seas squid driftnet fishing area.

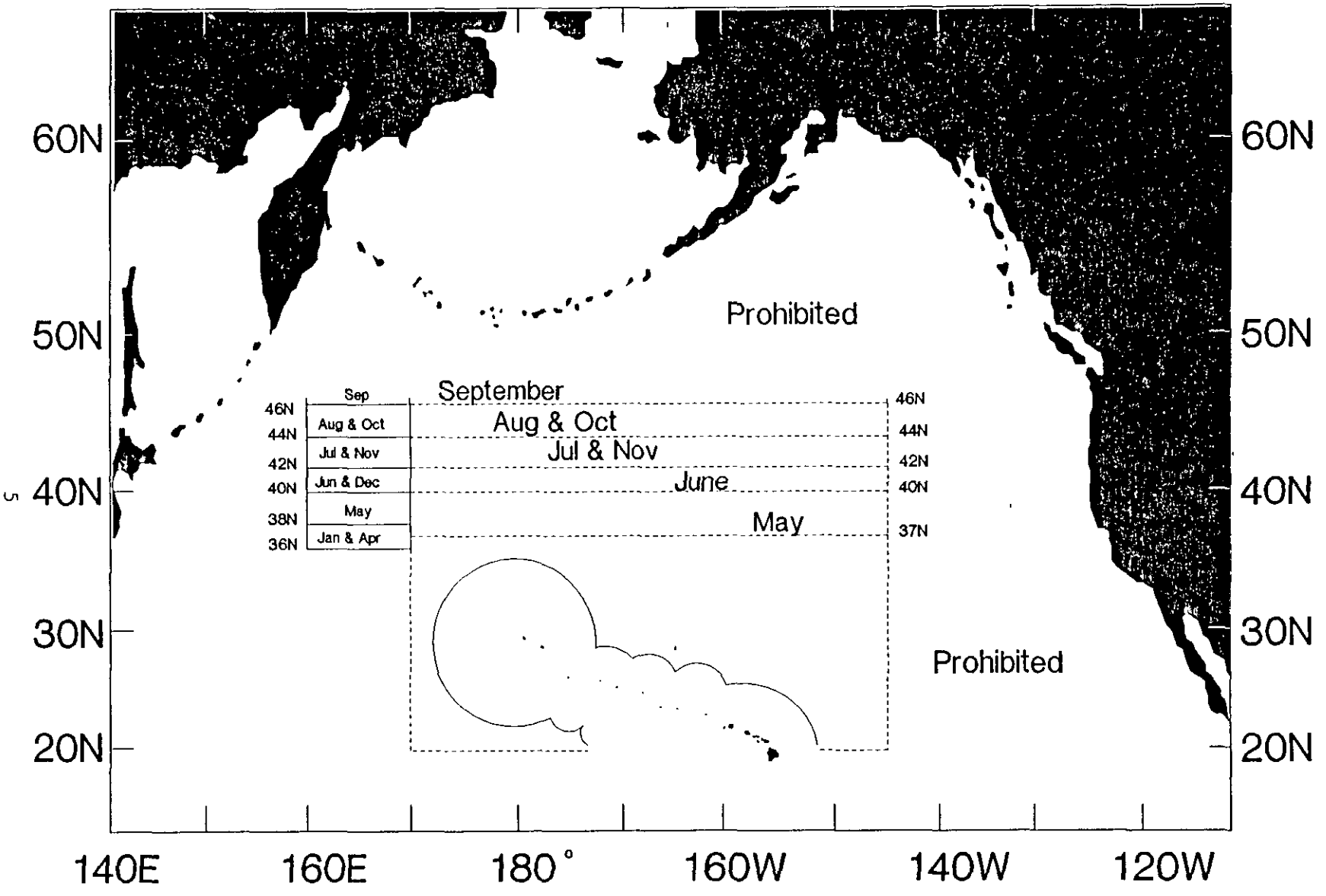


Figure 1-2.-- 1990 Republic of Korea high seas driftnet fishing area.

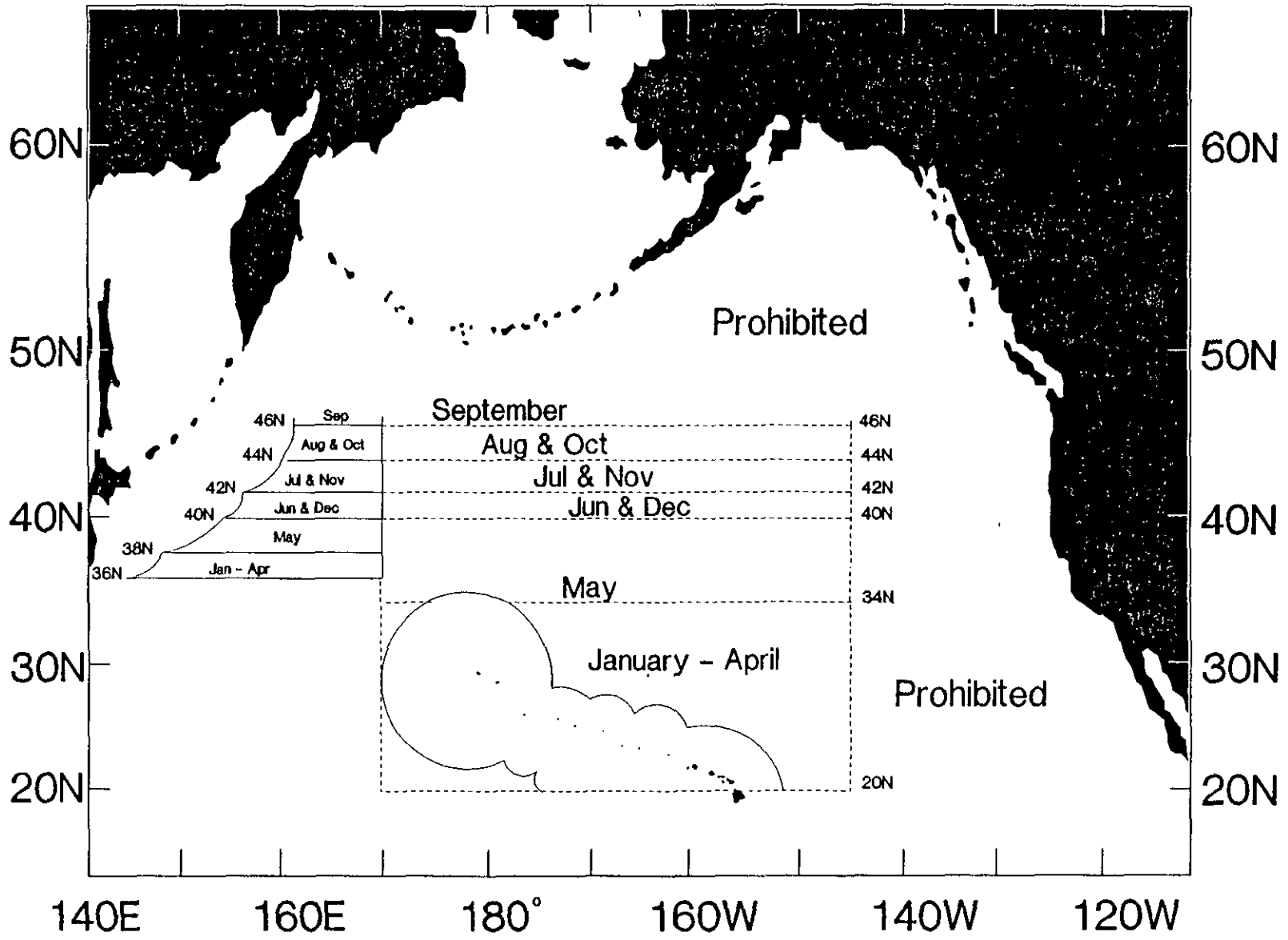


Figure 1-3.-- 1990 Republic of China high seas driftnet fishing area.

2.0 DRIFTNET OBSERVER PROGRAM

2.1 THE ROLE OF THE OBSERVER

As a scientific observer collecting data on the fishing operations and incidental catch of non-target species in the squid fisheries of foreign nations, each individual is expected to provide complete and unbiased data records which can be used to assess the bycatch of these fisheries.

It is imperative that the observer, as a guest of the vessel, conduct themself in a completely professional manner consistent with the actions of a government representative. The collection of complete, consistent and unbiased data necessitates observations often requiring long days under uncomfortable and possibly adverse conditions.

While at sea, the observer has several duties, which are outlined in this manual and during training. Prior to departure, the observer will be fully briefed on which duties are most critical for their cruise. **The observer must follow the instructions, and not deviate from the assigned priorities and duties. The duties and data to be collected are the result of international agreements and are not to be modified in any way during the cruise.** It is also essential that observer duties do not interfere with the normal fishing operations of the host vessel. Problems are to be documented and discussed with the Project Leader during debriefing.

2.2 OBSERVER RESPONSIBILITIES BEFORE TRAINING (U.S.)

Physical Examination

As a requirement for sea duty each observer must show evidence of having passed a physical examination within the last six months. In the information packet provided by the Contractor, the observer will find specific instructions and suggestions for locations of clinics in the Seattle area. The cost of physical examinations will not be borne by the observer. A physical examination to be conducted in Japan is also required for scientific observers on Japanese commercial squid vessels. This will be arranged by the Japanese after you arrive in Japan.

Personal Passport

Before reaching Seattle for training, the observer should obtain a personal passport, or if he/she already has one, ascertain that it is not due to expire during the cruise period. The responsibility for obtaining the passport is solely the observer's, as is the fee. Note that the cost of a personal passport is $40 (plus $6-10 for photos), and it is valid for 10 years.

Visa

Travel in and out of far eastern countries (but not Japan) require a Visa in addition to a valid personal passport. These can be obtained at no charge through consulate offices in the United States. To obtain a Visa for official business purposes, the observer will need:

1. A valid personal passport
2. An official letter of introduction (provided by NMFS)
3. A copy of the travel itinerary (provided by NMFS)

The observer will hand carry these materials to the appropriate office in downtown Seattle early in the training period. Turn around time for visas is usually 2-4 hours, so the observer will either wait or arrange to pick up the visa later that day. Note that the visa offices are generally closed between 1200 - 1300. The following are the Seattle consulates for Republic of Korea, and Taiwan:

Korean Consulate General
2033 6th Ave.
Seattle, WA 441-1011

Coordination Council for North American Affairs
Republic of China in Taiwan
Westin Building
Seattle, WA 441-4586

2.3 PREPARATION AND DEPARTURE (U.S.)

Communication

If the need arises to contact any individuals involved with the squid observer program, the observer should call (collect) one of the following individuals. All questions concerning pay, terms of employment, benefits, or any other topic concerning the employee/employer relationship should be directed to the Contractor, not NMFS staff. Questions concerning the data, data collection and/or the program itself can be directed to the NMFS staff.

Seattle, Washington

Heather Weikart	(206) 526-4213 (office) (206) 365-7775 (home)
Shannon Fitzgerald	(206) 526-4212 (office)

Japan Tourist Information Center (TIC)

The Japan Travel-Phone is a nationwide telephone service to aid tourists. When you are outside central Tokyo and Kyoto, you can get information or language assistance by dialing 106 and asking for "TIC please". The service is toll free. However, while you are in central Tokyo or Kyoto call the Tourist Information Centers by regular phone.

2.4 THE TRAINING PERIOD

The observer will receive approximately two weeks of training in the collection of biological data and the processing of specimens as they relate to the cruise. In general, the observer can expect to cover the following:

Day 1:

Introduction and opening remarks
History of the squid driftnet fishery
Nature of the squid driftnet program
International agreements
Oceanography of north Pacific ocean
Fishery, operation, and gear

Day 2:

Program goals
Observer duties; *pre-cruise meeting, set, retrieval, biological sampling*
Sampling schedule; set and section breaks
Language training
Net monitoring/logbook
General procedures
Recording by species groups
Dropout sections

Day 3:

Data record format
Language training
Set/retrieval supplementary data
Work routine and maintaining quality data
Japanese culture

Day 4:

Logbook and data record exam
Observer duties: biological sampling
Language training
Squid and marine fish identification and biological sampling

Day 5:

Salmon identification and biological sampling
Sea turtle identification, biological sampling, and tagging

Day 6:

Maintaining health at sea
Shipboard safety
Psychology of long trips
Language training
Safety
Survival suit training and practice

Day 7:

Daily logbook
Radio reporting: content and procedures; use of SSB
Language training
Dr. Aron addresses class
Post cruise duties; reports and debriefing
Travel

Day 8:

Marine mammal identification
Language training
Marine mammal ID exercise
Seabird identification

Day 9:

Biological sampling; concurrent marine mammals and seabirds
Language training

Day 10:

Survey techniques
Language training
Final exam
Final instructions
Issue of gear

2.5 OBSERVER CLOTHING AND EQUIPMENT (U.S.)

Each observer is responsible for the preparation of his/her own personal gear, as only scientific gear will be provided by NMFS. In general, the observer should be prepared for a wide variety of environmental conditions ranging from warm and humid to cold and wet. If the observer plans to take along an expensive cassette player, watch of foreign manufacture, personal binoculars, etc., he/she should register them at Customs, SEA-TAC Airport, prior to departure from the U.S. to avoid possible tariffs upon reentry to the U.S.

The actual cruise track or anticipated fishing grounds will dictate the final selection of gear. The observer should pack light, but efficiently, remembering that he/she will also be carrying gear issued later. The following personal gear is recommended:

Personal Items Supplied by Observer

Work clothes --minimum number and type

Cotton socks - 2-3 pair
Wool socks - 2-3 pair
Thermal socks - 2-3 pair
Polypropolene underwear - 1 set
Underwear - 4-6 sets
Work pants or jeans - 2 pair
Flannel or chamois shirts - 2
T-shirts - 4
Wool sweater - 1
Sweatshirt - 1
Scarf - 1
Wool hat or equivalent - 1
Baseball cap - 1
Medium weight jacket - 1
Light weight sneakers - 1 pair
Sandals or slippers - 1 pair

Clothing during travel or in port

Dress clothes - 1 set
Shoes (acceptable w/ dress clothes) - 1 pair

Other items or articles

Daypack - 1
Seabag or dufflebag - 1 medium
Toilet articles
Towel and washcloth
Language dictionary

Optional/Recommended

Wristwatch and Travel alarm
Sunglasses
Reading material and photos of family, home town, hobbies
Cassette player and tapes
Vitamin supplements and medication for motion sickness
Needle and thread for repairs
Extra glasses / contacts
Laxative and Diarrhea control medicine
Salt water laundry detergent and toilet paper (small amount of both)
Water flavoring and Water bottle (1qt) to keep drinking water in your cabin
Favorite foods (small quantities)

Equipment Supplied by NMFS

Data Forms

Bridge Log 100
Catch Log (Enough for 50 operations)
Marine Mammal Sighting Forms 50
Driftnet Observer Data Form 1's 60
Driftnet Observer Data Form 2's 120
Driftnet Observer Data Form 3's 120
Driftnet Observer Data Form 4's 60
Supplemental Forms for Special Projects

Reference Guides

Driftnet Manual 1
Species Identification Manual 1
Seabirds: An Identification Guide (Harrison) 1
Guide to Pacific Coast Fishes (Eschmeyer) 1
NMFS Circular 444 (Marine Mammal Identification Guide) 1
Beached Marine Birds and Mammals (FWS) 1
Language Guide

Gear

Survival Suit 1
Mustang Suit with stuff sack 1
Boots 1 pr
Raingear 1 set
Hardhat and chin strap 1
Rubber gloves 1 pr
Wool gloves 1 pr
Ear plugs 1 pr

Miscellaneous

Bungee cords 2
Watch 1
Roll strapping tape 1
Length of twine 25'
Package assorted plastic bags 1
Flashlight and extra D-cell batteries 1
Binoculars 1
First aid kit 1
Camera and film

Office Supplies

12" ruler 1
#2 Medium Pencils 6
Black ink pens 6
0.7 mm-lead Mechanical Pencils 2
Large eraser 1
Pencil Sharpeners 2
Packages 3-hole reinforcers 2
Calculator 1
Package rubber bands 1
Green Daily Logbook 1
Clipboard 1
8½x11" Notepad 1
Rite-in-rain Notebooks 3
Manila Envelope (to store radio messages) 1

Biological Sampling Equipment

Dividers 1
Tape Measure (to 4 m) 1
Forceps 1
Salmon Scale Cards 20
Hand counters 3
Mesh calipers
Gonad balance (Observers on Japanese vessels)
Turtle tagging kits
Marine mammal dissection kit (special project)
Seabird dissection kit (special project)
Salt
Snout bags

Care of Equipment

Mustang exposure suit - The Mustang suit is provided as a means of protection from wind and moisture while on deck. It replaces the need for heavy jacket and rain gear in many cases. During dissections or during any other activity that will expose it to blood or fish slime it is recommended that you wear raingear over top of your mustang suit. Although it is considered a Class V personal floatation device, it is not a surrogate for the survival suit.

Binoculars (7 x 50) w/cleaning fluid and lens paper - The binoculars provided are of high quality and made especially for the marine environment. Although they are described as "armored", they should be handled as a precision instrument. All binoculars of this type are particularly susceptible to mis-alignment when jarred. Be aware that the cost of replacement for the binoculars is $200 - $650 per pair (depending upon the type issued).

Camera (35mm) and film - A lightweight camera will be provided for official use only, to photograph specimens and to document shipboard activities as requested. Care should be taken in use and storage of the camera and film. All film exposed during the cruise is U.S. government property, and will be processed immediately upon return to Seattle. Arrangements for copies of pictures taken can be arranged through NMFS.

2.6 TRAVEL TO THE SHIP (U.S.)

Traveling as a Contract Observer

The cruise officially begins when the observer leaves his/her temporary residence in Seattle enroute directly to the airport on the date of departure. While traveling and onboard ship the observer is representing the U.S. Government, but travel is provided by the Contractor and travel records will be kept in accordance with the specifications prescribed by the Contractor. All expenses for lodging, meals, currency exchange, excess baggage and miscellaneous supplies should be documented with receipts. Maintain a clear record of the expenses for computation of travel costs and reimbursements upon return.

Shipment of Gear

The observer carries the liqui-paks with him to the various ports whether traveling via auto, bus, train, or airplane. If traveling by plane, the liqui-paks are normally transported as part of you personal luggage. Excess baggage costs can usually be avoided by careful planning and keeping the number of personal and equipment items to a minimum. Distribute baggage weight between your pieces of luggage so that no piece exceeds the weight limit of the airline you are flying with (approximately 70 lbs). The usual procedure is to pay cash for the amount of excess baggage at the time of check-in, so it is very important to limit the amount of personal items and to allocate enough cash to pay for the excess baggage upon your return. Do not ship your baggage unaccompanied. You cannot do your job without your gear. If you get separated from your luggage, initiate a luggage search from your end immediately. Do not board a vessel without your luggage even if you are told it can be brought to you later.

Special Foreign Travel Considerations

Travel from Seattle to the port of embarkation should proceed with a minimum of complications, aside from the usual pitfalls all travelers must face. The process of finding the point of embarkation will be facilitated wherever possible by contacts at the point of arrival. If this is not possible, then directions to connecting transportation or lodging will be provided, as possible, prior to departure. All observers should be prepared, however, to be resourceful in finding their point of departure on schedule. Certain difficulties in making connecting flights, especially in Korea, are already identified, and the observer will be appraised of the appropriate contingencies.

Travel back from the point of disembarkation is likely to be somewhat more confused than the embarkation leg. The observer should be prepared to handle the following situations before or on the trip home:

1. Payment of shipboard per diem - The scientific observer will not need to pay for his/her food consumed onboard the vessel. This payment, has been taken care of by NMFS. If questioned by the vessel personnel you should direct them to contact their fisheries agency.

2. Traveling with biological specimens - The observer may be returning home with biological specimens preserved either by freezing or in formalin. Prior to departure from the fishing vessel or research vessel, prepare the specimens as follows:

Frozen Material - pack the specimens in the cooler and top with as much crushed ice as possible. The crushed ice may need to be replenished or the cooler placed in a freezer if the observer is unable to secure a flight to the U.S. within 24 hours. Be certain that the drain plug is closed and taped. Place one copy of the collection permit, in a sealed ziplock bag, inside the cooler. Secure the cooler lid with the straps provided. Attach a label (written in black felt tip marker on a 5 x 8 index card) addressed to NMML, care of Dr. Linda Jones on the lid. Do not seal the cooler closed with tape since it may need to be opened for inspection at Customs.

Formalin Material - drain off the formalin in the storage bucket and temporarily remove the fixed specimens. Rinse the bucket with sea water and line it with a plastic bag. Place the specimen materials in ziplock bags by type (e.g., testis bagged separately from ovaries) and place back into the lined bucket. Seal the liner bag. Place one copy of the collection permit (provided by NMFS) into a ziplock bag, seal and place inside the bucket. Seal the bucket firmly. Attach a label to the outside as in the case for the cooler. The observer should carry the small hacksaw provided by NMML in an accessible location in case Customs wants to inspect the bucket contents.

3. Airline reservations - The round trip airline ticket each scientific observer carries is open for the return flight which means that a seat has not been reserved for the observer on any particular flight. The observer must make the return reservation him/herself. This can be accomplished by calling the airline upon arrival in port, or if possible, arranging for reservations during the trip back to port. Each observer will be briefed on the best approach to reservations prior to the cruise. The aid of foreign fisheries or Embassy contacts may be involved.

4. Customs - All scientific observers returning to the United States must clear U.S. customs and immigration. The observer should have a copy of the collection permit (the same document sealed in each container holding specimens) ready for the customs inspector. No specimen material other than that requested by NMFS should be collected and carried back. This includes seabirds (unless a separate permit is provided), fish for personal consumption, or any other biological material found at sea. Any tariffs levied on goods purchased in foreign countries (other than for official purposes) will be paid by the observer.

5. Permits - A variety of permits will be needed for the transport of biological specimens. These will be issued to you before you leave Seattle. Be sure that you are given the specific ones needed for your special project assignment.

Initial Meeting with Fisheries Representatives

Soon after arrival in the foreign port, the observer will usually be asked to attend a pre-cruise orientation meeting. In attendance will be representatives of a fishing company, the ship's officers, scientists from the host nation, or government fisheries officials. The purpose of this meeting will be to introduce the participants and contacts, to summarize the cruise plan or observation arrangement and to address any last minute problems or requirements. The scientific observer's role in this meeting may be rather passive, in that it will be more important to listen to the discussion and take notes as necessary. If asked to summarize his/her role on the cruise, the observer will work from the letter of introduction provided as it will include a brief description of the observer's major duties. The observer will be given instructions prior to departure regarding any special concerns to be addressed at the meeting.

On any cruise where biological sampling is planned, the observer should indicate that a small supply of formaldehyde will be needed for the preservation of specimens collected. He/she should inquire about local availability (funds will be provided to purchase the supply) or whether or not a supply is available onboard ship (research vessels will almost certainly carry some, but catcherboats normally do not). One or two pints will be sufficient in most cases.

2.7 LIVING AND WORKING ABOARD THE SHIP

As is the case at all times onboard ship, the observer should maintain open and friendly relations with the crew, particularly the officers. The observer will follow the instructions given by the vessel operator and will minimize interference with normal vessel routine. In particular, the observer should seek permission of the master before routinely entering the bridge to obtain positions and environmental data. A bridge officer should introduce the observer to the instruments and restrictions on their use prior to the start of data collection. It is imperative that the observer reflect a cooperative and competent character as his/her actions will impact the level of cooperation in the future.

Observers should be familiar with the operation or interpretation of certain electronic equipment. In general you should always seek the assistance of vessel officers in using equipment as they will not appreciate your adjusting equipment settings. However, you should become familiar enough with the equipment to make readings. Bridge equipment for all vessels consists of the following general categories: navigation, fishing, and communication.

Vessel navigation is facilitated by a few basic pieces of equipment. On most vessels position is determined by a satellite navigation (SATNAV) system which operates by obtaining position information from one or more orbiting satellites. During the interval between satellite passes, position is corrected using vessel speed and course information. Vessel orientation and navigation with respect to other vessels in the fishing fleet is accomplished using radar. This navigation device will be useful in determining the number of ships within 15 nautical miles during the driftnet setting procedure. Another important navigational device is the ship's compass. Many ships use a gyro-compass and thus provide the course in degrees true rather than degrees magnetic; it is necessary to ascertain which is in use, you need to record in degrees true.

Fishing equipment located on the bridge usually consists of temperature recorders, radio buoy locators, and depth sounders. As driftnet setting position is often based on thermal patterns, sea surface temperature is continuously monitored from the bridge using hull mounted thermistors. A variety of readouts may be present including digital display and printer tape. Sea surface temperature data may also be interfaced to the ship's plotter to be recorded at specified way points and shown in relation to course and section locations on the plotter video screen. Radio buoy locating equipment is essential in efficient location and retrieval of driftnet. Echo sounders may occasionally be used for locating fishing areas. Although squid are poor acoustical targets and generally do not appear on the sounder the presence of fish may occasionally assist in the identification of squid fishing areas.

A variety of equipment may be present for long range communication. The most common types of ship to shore radio equipment are morse or telex, which require a trained radio operator to use. Less common is a satellite telephone (inmarsat) which provides cellular phone style communications but is very expensive ($15/min) and should be used for emergencies only. Communication between vessels in the fleet is usually by single side band radio (SSB). On some ships SSB may be the only means of communication available. Because of possible conflicts in radio use and language problems, scheduling conferences with other observers may

be more easily carried through the ship's radio officer. For those observers going to vessels where communication with your home office is only possible using SSB, have the call initiated and logged by the vessel's radio operator. You should be aware that the power of the sets on some vessels may present a radio-frequency shock hazard, which can knock you off your feet and cause an RF burn.

Other useful bridge equipment that may be present includes an anemometer, to measure wind speed and direction, and a facsimile receiver for receiving weather maps and daily newspapers.

2.7.1 Living Conditions

As a guest of the fishing vessel, the observer will be courteously treated. Living conditions will vary widely depending on the ship type, age of vessel, and nationality. In the 1989 Japanese fishery observers reported the whole spectrum in accommodations: "accommodations were cramped, leaving little room for storage or movement", "The cabin that the Japanese observer and I shared was the size of a phone booth", "observer room had an adjoining private shower and toilet, spacious desk, fridge, water heater, and a VCR and TV with about 40 video cassettes, mostly in English". On most vessels bedding will be provided. Sleeping bags and pads will be issued if we know or suspect bedding is not available.

Meals on Japanese vessels will generally consist of rice, fish, soybean soup, and pickled vegetables. Semi-western foods may also be served occasionally. Many observers have reported that their meals were self-serve or self-cook. One other thing that seemed to be consistent throughout the Japanese fleet in 1989 was that no matter the age, size, or general condition of the vessel food was generally very good and plentiful. Although most vessels will not have Western-style snack foods available, there is usually a supply of instant noodles available. Korean meals consist of soups, fish, and rice. Soups are very spicy and may be hot to the North American taste. Food on Taiwanese vessels usually consist of poultry, fish, rice, and vegetables. Each observer will be given an advance to purchase his own supply of "goodies". Please remember that all your baggage will have to be taken on airplanes, trains, busses, and taxis; every effort should be taken to keep bulk and weight to a minimum.

Saltwater baths are normally available on Japanese vessels, but may not be available on Korean and Taiwanese vessels. Laundry facilities are usually available, though some observers report washing clothes by hand. We also understand that the laundry can get quite congested at times, therefore you may find it easier, and much appreciated, if you do your laundry on your day off.

2.7.2 Safety

Fishing vessels have many potentially dangerous areas. Extreme care should be taken to avoid injury. In addition to the personal suffering that would result, the observer program could be drastically hampered. The following points must be adhered to while on the vessel:

1.) The first day aboard, note where the lifeboats, life preservers, and other safety devices are kept. Memorize the exit route from your cabin, the factory, the mess, and other locations where you spend a fair amount of time. Keep your survival suit where you can get at it in an emergency.

2.) You are to obey the instructions of the captain, concerning you safety, as he is responsible for you safety. During your first talk with the captain, ask him to explain to you what to do in the event of a major emergency such as a fire aboard the ship, a serious collision with another vessel, or other conditions which might require abandoning the ship. Find out whether there is anyone who would be responsible for your safety in the event of such an emergency.

3.) Observers will wear hard hats and mustang suits at all times when on deck.

4.) During setting operations stay clear of the setting area. Similarly during retrieval stay off the working deck.

5.) Observers should not run aboard the vessel. Slipping, tripping, and bumping are all very common accidents which often happen when an observer is in a hurry. Specifically, the observer should watch out for slick spots where the deck is wet or frozen, the half-foot combing rising from the bottom of metal latch doors and passageways, and the low overheads of vessel ladderways.

6.) Treat all minor cuts, especially those on hands, with antiseptic to avoid infection from fish slime. Wear gloves when possible and wash hands thoroughly after sampling. Poisoning from fish slime is called cellulitis and is a form of staph infection. Should a staph infection be left untreated and allowed to develop, your lymphatic system becomes involved and the threat to your health becomes much more far-reaching than simply a pair of inoperative hands. Wash hands thoroughly after sampling in a solution of very hot water and an antiseptic such as betadine or providone iodine (1-2 oz. per qt of water). Disinfectants such as Clorox, Lysol, or Purex tend to sap your skin's natural chemicals and prolonged use may make you even more vulnerable to fish poisoning.

7.) If a fur seal, or other marine animal, comes up in the net DO NOT attempt to assist crewmen in untangling and releasing it. This is a good way to get bitten.

8.) Ask ship personnel which water sources are safe to drink. Some ships have lines containing water for washing and not drinking.

2.7.3 Safety In At-Sea Transfers

Observers will normally board and disembark their vessel at dock, but a transfer at sea may be necessary in certain circumstances. Transfers between vessels are potentially hazardous, especially in rough weather. The observer must assume responsibility for deciding whether or not to transfer based upon their own evaluation of the transfer conditions.

There are no hard and fast rules for allowable safety limits during transfers. Conditions such as vessel size, swells versus waves, current and impending weather, good lighting, and mode of transfer affect the decision as to whether or not to transfer. Observers must use their best judgement. Always go with an experienced crewman if you are transferring in a small boat or raft, and do not go until the vessel you are being transferred to is in sight. As general guidelines, do not transfer at dusk, in darkness, or in any other low visibility conditions. Transfers involving a small boat or raft should never be carried out at night.

2.7.4 Weekly Communications (U.S.)

The intent for radio communications in the driftnet program are threefold; (1) to maintain contact with the observer to track vessel position (in case of an emergency) and sample size, (2) to resolve data collection questions or problems, and (3) to assist in arranging return schedules. Remember, the intent of radio communications is neither for enforcement nor reporting of incidental take. Including this type of information in your message will only reflect poorly upon your role as an unbiased scientific observer.

Observers are to maintain contact with the Alaska Fisheries Science Center while at sea. International agreements allow radio contacts to be made on alternate calendar days. During normal operations, however, radio messages on Mondays of each week will suffice. Observers should discuss a radio reporting schedule during the pre-cruise meeting. Radio messages should be routed through the vessel's company or through the appropriate fisheries agency, the U.S. Coast Guard should only be used in case of emergency. The timing of messages should be arranged to interfere as little as possible with the other duties of the radio officer. Beyond maintaining weekly contact there are no strict reporting times or schedules. During the pre-cruise meeting, or soon after boarding the vessel, you should determine the type of equipment on the vessel. Past experience indicates there is a wide variety of radio communication facilities. Flexibility is again important. Note that if voice communication is the only method available the radio officer must transmit the message character by character using the international phonetic alphabet. For this reason try to keep messages as simple as possible. Avoid simplifying or abbreviating to the extent that we are unable to understand the content of the received message.

The message includes the following:

(1) Destination
(2) Observer Name and ORC Code
(3) Date (MMDDYY), Vessel Name and Number, and International Radio Call Sign.
(4) Position at midnight.
(5) Activity (i.e., Fishing, Transit, or Storm)
(6) Number of Operations Completed (OBE), Number of Operations Observed (OBSD).
(7) Additional Comments as Appropriate. These comments would include reports on any accidents and injuries, the date of the first observed operation, the date arrived on the vessel (if transferred from another vessel), and any information on a tentative return.

Radio communications are a difficult aspect of the program for all concerned. Messages will likely be relayed to the host nations driftnet fishing association, then by facsimile to Alaska Fisheries Science Center. An immediate reply to messages may be difficult, especially if sent over a weekend. Past experience indicates a reasonably good return time to questions, often within 48 hours. Radio messages are not intended for communication with your family. Observers should be prepared for this aspect of the cruise. We will contact you if an emergency should arise, and make arrangements for transport home if need be. Otherwise, be prepared to be out of contact with your family for several months.

All messages should be neatly printed and a copy (if not the original) saved in the manila folder provided. Create a table in your cruise logbook to record the dates messages are sent or received.

EXAMPLE 1 Routine Message, Sent Every Monday.

TO: RUSS NELSON, AFSC, NMFS, SEATTLE WA.

FROM: JOE OBSERVER ORC 710P8

060590 MATSUSHIMA MARU 38 JVCX

3916 17356W. FISHING

0PE 7P7, OBSD 6P6.

FIRST OPE DATE 053090

In this example Joe Observer is reporting from the driftnet vessel Matsushima Maru 38. The vessel is fishing, located at 39°16'N and 173°56'W. There have been seven operations made since Joe's arrival on board; he has observed six of these. The date of the first operation was 30 May 1990.

EXAMPLE 2 Special Message. Send as Required

TO: RUSS NELSON, AFSC, NMFS, SEATTLE, WA.

FROM: JOE OBSERVER ORC 819P18

061590 MATSUSHIMA MARU 38 JVCX

3950 17821W FISHING

OPE 19P10, OBSD 16P7

SEABIRDS NOT RETAINED FOR OBSERVER. UNABLE TO CONDUCT SEABIRD SAMPLING.

Note that in the second example seabirds were not being retained by the crew. Before sending a radio message to resolve this type of problem you should exhaust all means available to you, such as the letter of introduction, poster, translated phrases, and your own communication skills.

In case of an emergency you may be able to directly contact the Coast Guard. These are the channels and frequencies which should be used:

Channel 22A2670kHz
Channel 162182kHz

2.8 DUTIES BETWEEM DEPARTURE FOR GROUNDS AND DISEMBARKATION

On commercial cruises, the scientific observer may spend up to ten days transiting to the fishing grounds. The transfer vessel may be the fishing vessel itself, or a large transport (freighter or tanker). No fishing activity will be observed during this time, so maximizing marine mammal or seabird sighting effort by those assigned this project will not conflict with any other duties. Otherwise, observers should review the manual and identification guides as necessary during this period. Some parts of the cruise report which concern the initial meeting and travel to the point of embarkation can also be drafted.

On the return trip from the fishing grounds back to port, observers should again prioritize marine mammal or seabird sighting effort, if they have been assigned that duty. As on the outbound leg, this portion of the observer's duties is critical and shall not be considered optional.

As time allows, the observer should begin the process of preparing tables and text for their cruise report. The data forms and logbook should be complete, and rechecked again at this time. A significant amount of confusion during debriefing can be alleviated by careful compilation and summarization of the data records. Refer to Section 3.5 for instructions on cruise reports and debriefing.

2.9 OBSERVER RESPONSIBILITY AFTER THE CRUISE

Upon arrival in Seattle, the observer should notify the Contractor and NMFS. The initial debriefing meeting will be held at the National Marine Fisheries Service about one day after arrival in Seattle.

Normally, debriefing will take five to ten business days, but the actual duration will depend upon the volume and quality of the data collected. During this time the scientific observer will work closely with the debriefing staff, and must be prepared to submit data forms, logbooks and a draft of their report on schedule. Likewise, the observer should be prepared to remain in Seattle until all data and the cruise report have been accepted.

The equipment issued to the observer must be cleaned and returned. The equipment will generally be collected on the first or second day back.

The observer should arrange to meet with the Contractor to handle travel expenses and reimbursements.

2.10 FISHING OPERATIONS

2.10.1 General Description of Fishing Vessels

The driftnet fleet consists of a variety of types of ships, varying in age, size and design. In general all ships in the fleet are capable of extended periods at sea, ranging from 70 to 120 continuous days. Vessels accommodating observers in 1989 ranged in size from 224 to 500 gross registered tons, corresponding to approximately 40 to 60 meters in overall length and crew sizes of approximately 12 to 24.

While some of the ships may be very new, many are over 10 years old having been refitted from use in other fisheries. The driftnet fleet consists of several different classes of vessels: ships originally built as salmon driftnetters which operate in squid and large mesh driftnet fisheries (Figure 2-1A and B); ships originally built as longliners, jigging vessels, and stern trawlers (Figure 2-1C) and have been converted for the driftnet fishery. Some of the vessels may be designed to change from driftnetting to perform longline, jig or trawl operations for other fisheries.

All driftnet vessels have a large working deck, usually located forward of the bridge, for retrieval of the driftnet and processing of the catch. At the stern of the vessel is a large net well and net roller used for storage and deployment of the driftnet. Interconnecting these two areas is a large diameter tube for transferring the net. Some driftnet vessels have a designated factory for processing catch but for most this activity is carried out on the retrieval deck. All driftnet ships have one or more blast freezers for rapid freezing of the day's catch prior to long term storage in the fish holds. Some vessels are equipped with accessory trough (dropout catchers) designed to catch dropouts near the rail over which the net is retrieved. If your vessel has a dropout catcher be sure to note the specific instructions outlined in section 3.2.1.

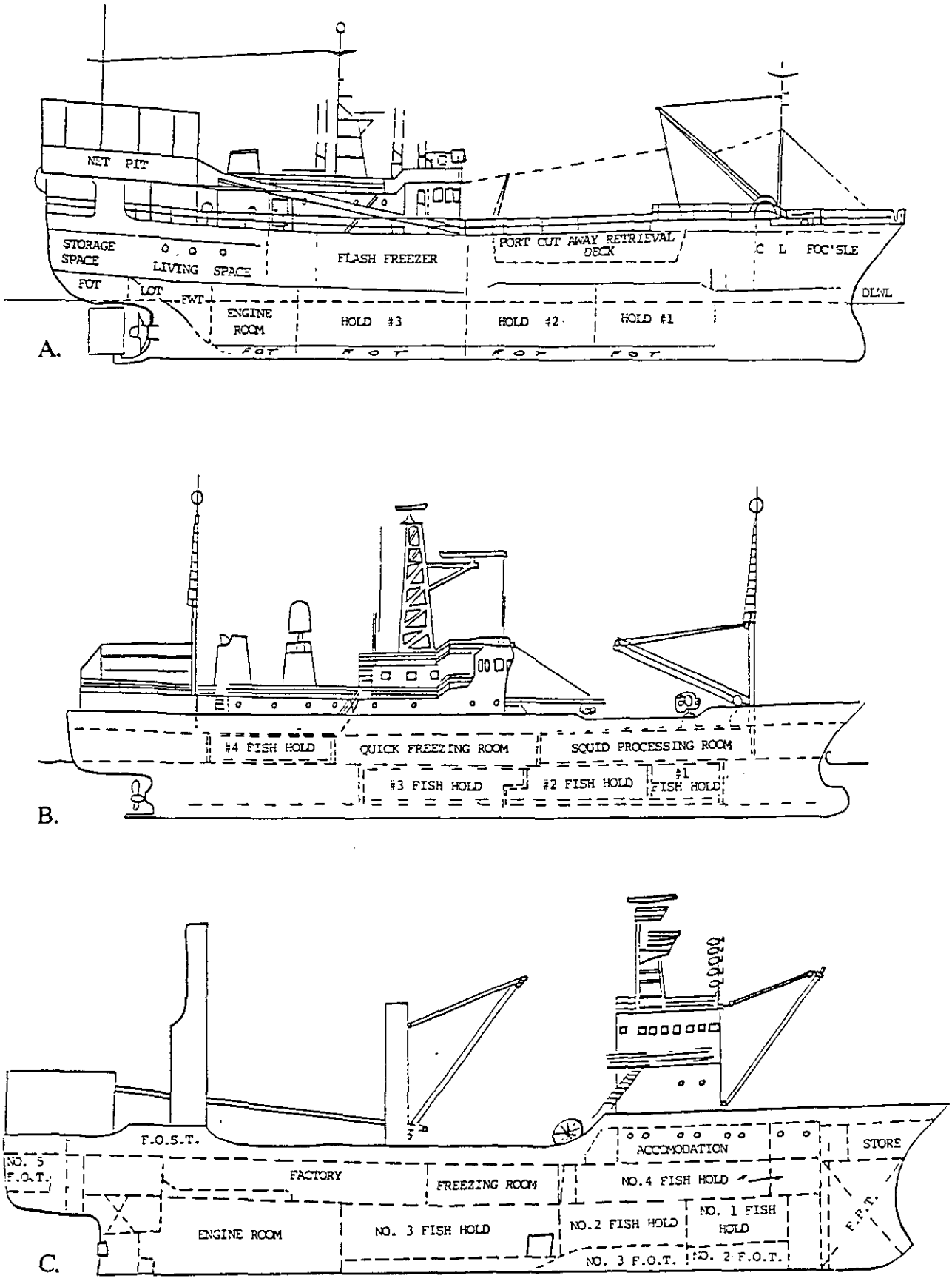


Figure 2-1.-- Fishing vessel profiles for dedicated driftnet ships (A and B) and a converted factory trawler (C).

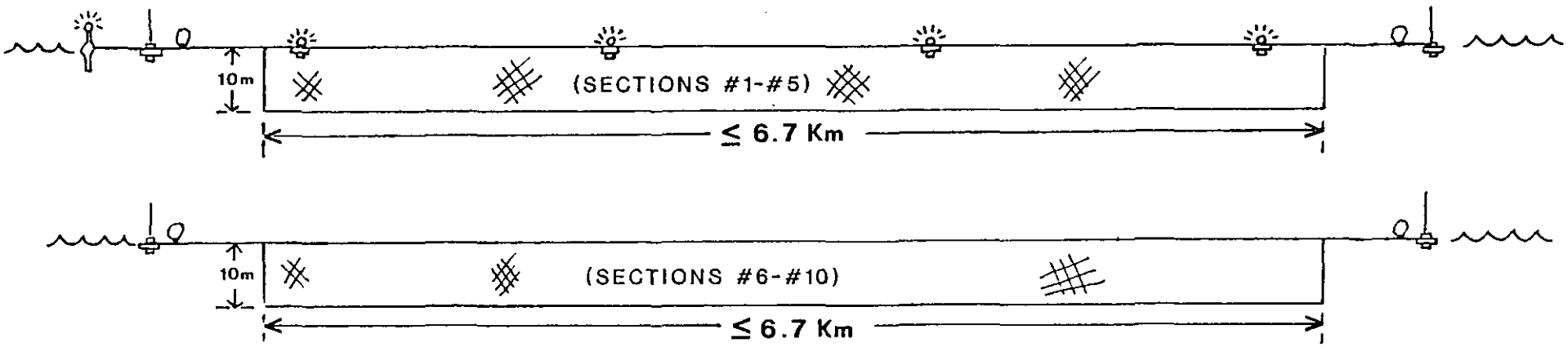
2.10.2 Net and Fishing Gear

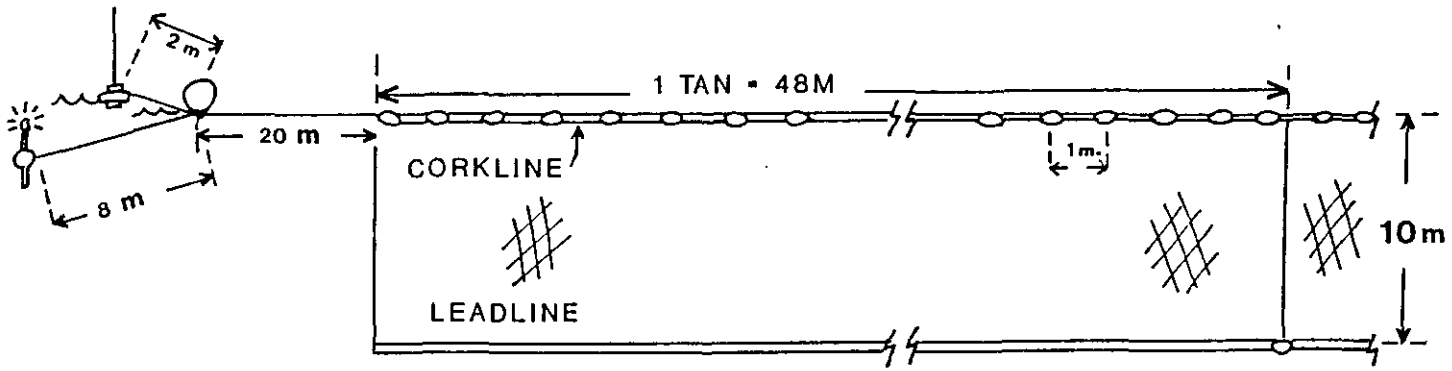
A few basic definitions will aid in the understanding of squid driftnet gear (Figure 2-2). An **OPERATION** consists of the entire quantity of net set daily which may be as much as 70 km of driftnet. For convenience in handling, the operation is divided in a series of driftnet **SECTIONS** which are usually deployed separately from one another and marked at either end with some form of locating device such as a light or radio beacon. Driftnet sections consist of a series net panels (**TANS** on Japanese vessels, **POKS** on ROK vessels, and hereafter referred to as tans) each measuring approximately 50 meters in length by 10 meters in depth. Individual tans are linked to form a full net section by tying the float and lead lines of adjacent tans together, binding the knots with waterproof electrical tape, and lacing the webbing of each with a light line. A net section may consist of approximately 150 tans having a total length of 7.5 kilometers although in rough weather the effective length would be less due to wave action. In calm weather several sections may be joined together by lengths of rope at the cork and lead lines to form a "multiple section".

At the start of the fishing season all netting may be new such that there is little or no variation in net wear per tan, tan length or the number of tans per section. As the season progresses increased variability in fishing ability between sections will vary due to net wear and removal of damaged tans.

The components of a standard tan are the **FLOAT LINE** (or **CORK LINE**), **LEAD LINE** and **MESH**. The float line (or cork line) is a small diameter double line with one or two types of styrofoam floats spaced approximately 1 meter apart (knowledge of this distance may serve as a useful means of verifying tan length). The lead line (or foot rope) is a heavier weight lead core line which takes much of the tension during net retrieval. Some tans may also have external weights surrounding the lead line spaced about 0.5 meters apart. The mesh is almost entirely monofilament nylon web (approximately 0.5mm in diameter), 10 meters deep with stretched mesh size of 115mm attached to float and lead lines by a light weight line. Some vessels may use sections with the fishing mesh suspended one or two meters below the surface.

Three buoy types may be used to assist in locating the end of a driftnet section: radio, light, and scotchmen (Figure 2-2). The general pattern of deployment for buoys is a radio buoy and another buoy (either light or scotchman) for the initial setting or planned retrieval end of a net section and a single radio buoy at the opposite end. In addition, two to four plastic light buoys may be placed singly along each of the first four or five sections retrieved to facilitate navigation along the section during darkness.





STRETCHED MESH SIZE = **115 mm**

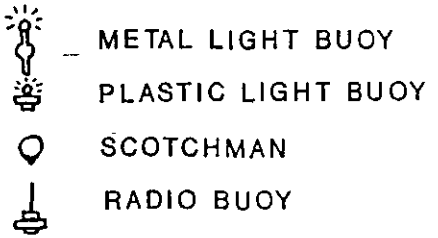


Figure 2-2.-- Specifications for typical squid driftnet sections, tans, and buoys.

2.10.3 FISHING PROCEDURES

Interaction among vessels in the fishery takes place for a variety of reasons with the type of information shared and with whom varying depending upon the objective. Fishing vessels operating in the same region may share position and setting intention information to avoid crossing fishing gear. Often groups of vessels will cooperate in their fishing efforts in order to obtain more complex driftnet deployment patterns. Cooperating vessels may also share information to gain a larger spatial perspective of water temperatures or catch distribution. In 1989 observers on Japanese vessels reported that although the radio operator kept track of all the vessels, and their sets, in a given area catch information was only shared with a few other ships. We have been informed that on Korean vessels the arrays are very structured with the senior captain directing the general area fished and the setting position for each vessel in his array.

Driftnet operations, whether conducted on board commercial or research vessels, share several common features. All operations include the set, the soak, and the retrieval. The following is a typical daily schedule:

0200 Standby - crew arises, prepares to begin the retrieval. The vessel runs to the end of the net to be brought onboard first. The observer also arises, and may eat during his first section break in accordance with arrangements made upon arrival on board.

0430 Driftnet retrieval begins, the observer is on station to monitor the operation.

1200-1500 Driftnet retrieval ends. The observer will normally do any biological sampling at this time. The second meal of the day may begin now, or has already been eaten, in shifts, late in the retrieval.

1500-1900 Vessel runs to the vicinity of the next set position, crew processes the catch, gear repaired and readied for the next set. The observer rests, reviews morning data.

1700 Driftnet set begins. After the observer verifies set time and position he is free to go to bed if he chooses.

2100 Driftnet set completed, vessel runs to its drift position for the night. Third meal of the day served, crew retires thereafter.

Set

Typically, driftnet deployment occurs prior to sunset and requires 2 to 4 hours to complete. Net sections are usually deployed on a straight line on an east-west axis. Although this arrangement may be modified due to strong winds and fishing conditions. One set pattern used to optimize fishing performance is an offset array with driftnet sections being deployed along parallel east - west headings but offset with as much as 10% overlap between adjacent sections. Another setting pattern is with multiple sections deployed in parallel rows. For example, 10 sections may be set in a 5/5, 6/4, or a 4/3/3 configuration. These special setting

patterns are usually only possible if fishing gear from other vessels is not set nearby. Other types of irregular setting patterns may occur and should be described as fully as possible.

Setting usually requires six crew members; the fishing master to navigate the vessel, two men operating the net well, two men organizing and releasing the locating buoys, and the bosun to oversee operations at the stern of the vessel. Once the vessel has been brought to the starting position the crew readies the net, buoys, and lines for setting. A crew member releases the locating buoy(s) from their lashings and the buoys drag the net section out over the stern roller. The stern roller is in three different diameters: the lead line passes over the smallest diameter roller on the starboard side; the float line passes over an intermediate size roller on the port side; and the web goes over the middle part of the roller which is the largest diameter. Two crew men in the net well tend the float line and the lead line. One man may have a long pole which is used to keep the float and lead lines from crossing. Two strong water jets, directed aft in a "V" shape from nozzles located below the spinning net spool, keep the float and lead lines separated and mesh untangled as the net passed over the spool. When the first net section end and buoy have cleared the vessel, the next section's buoys are released with the procedure repeated until all sections have been set.

Net Soak

The soak refers to the period during which the net is left in the water without any direct contact from the vessel. Squid nets are left to soak throughout the night. Sea conditions and fishing master preference may influence the duration of a specific soak, but the overall strategy involves maximizing fishing effort while the target species are thought to be high in the water column.

Retrieval

The retrieval or haul operation is the longest, most complex, and most variable of the three segments. A typical net retrieval often takes 8-10 hours, but varies with catch density and weather. The retrieval operation generally begins 2 to 3 hours before sunrise. The net is usually retrieved in reverse of the order set; although, depending on wind direction, it may be retrieved in the same order it was set.

The single most important factor affecting the speed of retrieval operations is catch density, the longest and shortest retrieval times corresponded with the highest and lowest catch densities. Other factors affecting retrieval speed are wind conditions and net entanglements. High winds slow retrieval as the float line could be blown across the bow of the vessel or, conversely, the vessels bow could be blown across the net by wind gusts and wave swells. Net entanglements and the need to repair tangled net sections could slow retrieval rates by 30 to 80% for short periods of time. In order to maintain an efficient retrieval speed and catch processing rate the crew may rotate jobs frequently and concentrate their effort on the rate limiting step of the process, which at times could be the removal of the catch, processing, mending of the net or guiding the net through the tube.

The retrieval operations which require long hours to complete often result from poor sea conditions and/or large catch (both target and non-target). As sea conditions deteriorate the net is more likely to break apart into sub-sections, or become tangled. Each time a broken net end is retrieved, the vessel begins a search to locate the other end of the broken piece or the next marker buoy. Runs between broken net ends may take 30 minutes or more. To untangle large animals, particularly marine mammals, billfish, and large tunas, the vessel may stop, just as large catches of any species will result in slower vessel progress along the net.

During retrieval operations radio buoys marking sections are located by means of a transmitter (buoy activator) and radio direction finder located on the bridge. Radio buoys normally transmit a signal periodically throughout their deployment time. Each radio buoy has a unique call sign and when activated, the radio buoy transmission signal becomes continuous. The radio buoy signal is then translated onto a small display screen on the bridge which shows both direction and range relative to ship's position.

Net retrieval begins by bringing the initial buoy configuration on board. This is done by throwing a grappling hook across the line attaching the buoys to the net section, and then drawing the buoys to the vessel by means of a deck winch. Once along side the buoys are hauled on board manually. The actual hauling of the net is performed by two port deck winches located fore and aft on the retrieval deck. Throughout the retrieval operation the vessel keeps the net to port. The crew gathers by hand the net stretched between the lead line and cork line pullers and removes the catch as it comes over the rail. After removal of the catch, the driftnet is pulled through a tube to the stern net bin where it is stacked in preparation for the next set.

Ball type winches in the net well stack the "clean" net in an organized fashion, float line starboard, lead line port, with webbing piled evenly between. A simple yet efficient bell system is used to communicate between the working deck and the net well. A tarp may be placed to separate sections and eliminate tangles and foul ups. Section lines are tied to the side of the net well for later lashing to buoys at set time. When catch rates are high unpicked squid may go through the net tube, to be picked out by the net well men. Often pomfret (especially if small) that go through to the net well are left to rot or fall out of the net during the next setting operation.

Portions of net with large holes are removed a tan at a time for later patching and are replaced with the appropriate number of repaired tans from a supply carried on board. Net repair and replacement is done on the main deck, not in the net storage area.

Handling and Processing of the Catch

In the 1989 Japanese fishery handling of the catch varied considerably depending on the species involved. Squid were either picked out or violently shaken to remove them. Dense clumps of squid, large billfish, and large sharks were frequently winched aboard while smaller billfish, sharks and dolphins or porpoises were usually gaffed and hauled aboard by several men pulling together. The sighting of an albacore in the net caused a shout of "bo" or "tombo" and

one or two men carefully pulled the fish aboard by hand. Except if there were albacore or squid in close proximity, an attempt was usually made to shake out any pomfret or blue shark bycatch by hand pulling on the net in low densities or by manipulating the lead line and float line pullers, in high densities. The presence of pelagic armourhead raised a shout from the crew, as their spiny dorsal fins were a potential hazard to the crew. The sighting of a billfish or large shark usually resulted in one or two men readying long handled gaffs to secure the fish and assist in hauling it aboard. With large animals such as billfishes, the webbing had to be unwrapped from the animal by several crew members and occasionally the tails were cut off to aid disentanglement.

The manner in which squid and other desired species are handled varies between vessels by the type of machinery used and the processing area layout. In the simplest method all of the catch is processed on deck using knives and simple hand tools. In other instances machinery for slicing squid mantles and removal of mantle skin may be present. In general, squid processing consists of the following basic steps: cleaning, washing, grading (by mantle size), packaging, and freezing. Cleaning squid is accomplished by slitting the squid mantle along the ventral surface and removing the internal organs and tentacles, the head being left attached to the tentacles. Internal organs are disposed of and the mantle and tentacles are then placed into separate deck holding tanks. Any fins that come off in the retrieval process are also collected and kept. After washing, the squid products are removed and packed according to product form in freezing pans (usually 20 kg size). While basic forms are mantles, tentacles and fins, there may be several categories of mantles according to size, condition and presence of skin. Once graded and packed, the trays are stacked, counted, and placed on shelves in the blast freezer at minus 35 to minus 40 degrees centigrade where freezing time may be as much as 12 hours. The freezer pans are separated from the product blocks which may then be glazed in a seawater bath before transfer to the fish hold.

3.0 AT SEA DATA COLLECTION AND SAMPLING PROCEDURES

3.1 OBSERVER DUTIES

Monitoring of driftnet operations involves four overall objectives, they are given here in order of priority or importance.

1. Driftnet Retrieval Observation (Section 3.2)

2. Core Biological Sampling (Section 3.3)
   a. Salmon Biological Sampling
   b. Marine Mammal Length and Sex Data
   c. Marine Mammal Off-effort Sightings
   d. Seabird voucher specimens
   e. Turtle tagging
   f. Photographic Documentation

3. Specialized Biological Sampling (Section 3.4)
   a. Marine Mammal and Seabird On-effort Sighting Surveys
   b. Marine Mammal Dissections
   c. Seabird Dissections
   d. Marine Fish Length Frequencies

4. Comprehensive Trip Report (Section 3.5)

In addition to the collection of biological data, all observers should also learn as much as possible about the squid fishery through open communication with the vessel personnel and scientific staff. Refer to section 3.5 on the trip report for items that would be of interest.

The observers' daily activities on board commercial vessels will primarily involve monitoring driftnet retrievals. Although monitoring a net is not a physically demanding job, it can be very tedious. For this reason it has been decided that after five consecutive days of fishing the observer is to take the sixth day off for leisure time. No retrieval data, biological sampling, or specimens are to be collected during observer's rest period. The observer may record data on tagged animals from both moniored and unmonitored retrievals, and may also document marine mammal and seabird sightings (but not catch).

Each set of forms has its own set of variables, and instructions. Until you are thoroughly familiar with each form refer often to the instructions and the examples provided.

GENERAL DATA COLLECTION GUIDELINES

Refer to the following list of general instructions when making notations on data forms and logbooks:

1. Write with a soft (#2 lead) pencil on all data forms. An eraser should be used to correct errors made on the day of entry only. Any errors discovered thereafter should be noted in the logbook and noted during debriefing. If there are extensive changes necessary, make a list in the logbook.

2. All logbook entries should be made with lead pencil. Do not use ink or felt tip pens.

3. All data, including logbook entries should be printed, legibly.

4. Observe and accurately record objective data with explicit notes and explanations. Record data as they occur, trusting nothing to memory.

5. Fill in all blanks on data forms as instructed. Zero is considered data, a blank indicates data was not collected.

6. All transcriptions between logbook and the data forms must be 100% accurate. Both copies should be checked carefully for omissions and errors in transcription.

7. All compass readings are recorded in degrees true. Magnetic readings are not to be used. Note that true north is 000 degrees (not 360).

8. Record latitude and longitude to the nearest minute.

9. All times will be recorded as four digits using the 24 hour clock (military time). For example, 5:30 PM is recorded as 1730.

10. Use ship's time in all notations. If the clocks onboard ship are changed as new time zones are entered, observers should wait until the next morning to change their clocks so that all data collected from a particular day are consistent throughout. One hour time zone differences taking effect at the start of a new day will not impact the data collected since little data collection occurs over the midnight period. Keep a list of time zone changes in the logbook.

11. To clarify radio communications the number 0 is represented by Ø (slash through it) while the letter O is represented by O (no slash through it).

3.2 NET RETRIEVAL MONITORING

3.2.1 Overview

As you are one of many observers in the driftnet fleets, your role is to observe and record data in a manner that is consistent with all other observers in the fleet. Researchers from Japan, Canada, the Republic of Korea, the Republic of China, and the United States have developed similar procedures to be followed by observers. Our ability to analyze the data that you collect depends on you following these procedures. Your ability to follow the correct procedures depends critically on your knowledge and understanding of them.

Retrieval monitoring involves recording numbers of individuals of the target flying squid or albacore (in the large mesh fishery) species, numbers of bycatch of all other species, and the numbers of dropouts and shakeouts of all fish species in certain sections. The most abundant animals in the nets are squid followed by pomfret, blue shark and albacore tuna. Animal densities tend to be patchy.

Before you begin your first observation you will need to select a good monitoring location. Most driftnet vessels retrieve driftnets on the deck forward of the wheelhouse. You should choose a location that provides a safe, elevated, unobstructed view of the net. Examples are atop the pilot house, the flying bridge, or the bridge wing. The location should also provide a good view of what drops out near the vessel as the net comes over the rail. Some consideration can be given to the direction of rain and wind. If more than one good monitoring position is available, you may want to change depending upon weather conditions.

A driftnet vessel may set 8-12 sections of net each evening. You should monitor 6 sections when 6 to 9 sections are deployed and 7 sections when 10 or more sections are deployed. For statistical purposes, it is important that these sections are chosen randomly. The sections to monitor will usually change from day to day. You will determine which sections to monitor from the driftnet retrieval Sampling Tables in Appendix 6.

3.2.2 Bridge Log

You should fill out the Bridge Log for every operation monitored while you are on board. It is <u>your</u> responsibility to get this information. If the bridge watch is not providing it you need to do one of two things: either determine if the vessel is recording this information a ship's log and request permission to copy it from there, or request permission to use the ship's equipment to get the information yourself. On many vessels the bridge watch may fill out part, or all, of the form, but this would be done as a courtesy to you; it should not be expected or demanded. REMEMBER: before using any equipment on the bridge request permission and ask for instruction on the correct use of each instrument you wish to use.

BRIDGE LOG

Vessel Name IKA MARU #7 Licence No. 777

Operation No 8 Set Direction 090

Straight Line Set ✓ Y ___ N No. of Sections 8

Vessel's Time Zone JS

Order of Retrieval ___ First Section ✓ Last Section ___ Other

No. of vessels within 15nm (at start of set) 6

	START OF SET	END OF SET	START OF RETRIEVAL	END OF RETRIEVAL
DATE mo,da,yr	060790	060790	060790	060790
TIME	1520	1900	2202	0612
LATITUDE °N	3934	3930	3935	3929
LONGITUDE °E/°W	17945 W	17939E	17946E	17943 W
SEA SUR. TEMP .1°C	15.6	16.1	16.2	15.9
WIND DIRECTION °T	100			225
BEAUFORT STATE	2			2
SWELL HT. m	1			1

Please provide the following information to the observer. If the net has not been changed since the previous operation enter N/C.

SECTION	1	2	3	4	5	6	7	8	9	10	11	12
No. of Tans	150											
Mesh size mm	115											
Tan Length m	48											
Subsur Dep m	00											
Depth m	10											
Material	1											

Shaded areas are to completed by the observer.

3.2.3 Procedures

Step 1. Determine Which Sections to Monitor for this Operation

. Determine the Operation Number for the operation.

. Determine how many net sections were deployed for the operation you are about to monitor. (For example, suppose 8 sections were set.)

. Go to the Sampling Table, in Section 3.2.8, appropriate for the number of sections. For example suppose that 8 sections were set. The left hand column of this table has a sequential list of Operation Numbers. Scan down the column until you find the appropriate Operation Number for this set. The next 8 columns contain those sections to monitor and those in which to rest. (For example, if this is your first Operation and 8 sections were set, you would monitor Sections 1, 2, 4, 5, 7 and 8. For the moment, note also that Dropout sections are 7 and 8 ... this will be explained under Step 6, The Counting of Dropouts).

. REMEMBER: For sections not monitored do not collect any data, specimens, or biological samples.

Step 1. Additional material (5/7/90)

SAMPLING OPERATIONS WITH 6 OR FEWER LONG SECTIONS SET

Typically, 8-10 sections of driftnet are set in the Japanese squid driftnet operations in the central North Pacific Ocean. The sampling tables in the Appendix are designed to provide a random sample of net sections from operations consisting of 7-12 sections of driftnet. In the case of the squid driftnet fishery of the Republic of Korea (ROK), we know that typical operations consist of only 4-6 sections of net which approximate the total length of driftnet set in most Japanese operations. The ROK operations take about 4 hours for setting and about 10 hours for retrieving the driftnet, very similar to what was observed in the 1989 Japanese squid driftnet fishery. In some rare cases in the 1989 Japanese fishery, only 5 or 6 sections of net were set but they consisted of nearly as many total tans of gear as observed in a typical operation consisting of 8-10 sections. No information is available for the configuration of driftnet operations carried out by vessels from the Republic of China (ROC).

...2 Dropout Monitoring for Six Sections or Less

It has been agreed among the scientists of Canada, Japan and the United States that when 6 or fewer sections of driftnet are set in one operation in the Japanese squid driftnet fishery, observers will monitor all sections. Dropout sections can be identified by using the Appendix Table for 7 sections set; refer to the correct operation number and then examine the columns for dropout sections. Proceed down the first column and note the first two applicable section numbers which you could sample in the operation. For example, if 6 sections were set

then the only possible sections in which it is possible to count dropouts would be 4-5,5-6 or 4-6. Select from the table for 7 sections set the first two section numbers you encounter. If 5 sections were set then count dropouts in sections 4 and 5. If 4 sections were set then count dropouts in section 4; do not count dropouts in operations consisting of 3 or fewer sections since all of these sections will probably be retrieved in darkness. If it took considerably longer than 10 hours to monitor the retrieval for the set of 6 sections or fewer, then take the next day off to rest.

If the deployment of sections in the squid or large-mesh driftnet fishery of the ROC resembles the pattern observed in the 1989 Japanese squid driftnet fishery then follow the sampling technique which uses the Appendix Tables for operations of 7 to 12 sections set. If the ROC deployment of gear is similar to that employed by the ROK, i.e., sets consist of 5 or 6 sections which require about 10 hours to retrieve, then follow the sampling technique described below.

...3 Sampling Six or Fewer Sections

In order to get random samples from operations consisting of large numbers of poks or tans (>1000) deployed in only a few sections (4-6) and at the same time provide timely work breaks, the following sampling technique should be used.

When 4-6 long sections of driftnet are set in one operation they can be treated as double length sections of the more typical or shorter length sections. By treating the longer sections as double sections you can use the sampling tables in the Appendix to select your sample of sections to monitor. Simply double the number of the longer length sections and use the appropriate table, e.g., if 5 long sections were set, then treat the operation as if 10 typical sections were set and refer to the table for 10 sections set per operation to select your sample. In this example, the short sections 1-2 correspond to long section 1; short sections 3-4 correspond to long section 2; short sections 5-6 correspond to long section 3; short sections 7-8 correspond to long section 4 and short sections 9-10 correspond to long section For example, if your random sample taken from the table consists of short sections 1-2, 3, 5-6, 8 and 9 then the corresponding long sections are 1, first half of long section 2, long section 3, last half of long section 4, and first half of long section 5. In the case of sampling the first half of a long section, it is clear that you should begin monitoring at the beginning of that section and stop monitoring at some estimated half way point during the retrieval of that section. After a few operations you should be able to estimate the usual retrieval time for a section. For example, if it takes about 2 hours to retrieve one long section, then to monitor the first half section you should monitor for the first hour and then stop. In the case of sampling half sections YOU MUST RECORD THE TIME OF DAY AT THE BEGINNING AND END OF RETRIEVING THE WHOLE SECTION AND THE TIME OF DAY YOU STARTED MONITORING AND THE TIME OF DAY YOU STOPPED MONITORING THE HALF SECTION. In the case of monitoring the last half of a long section, the time at which you begin monitoring is found by adding the estimated elapsed time to retrieve the first half of the net to the time at the start of retrieval of the entire long section. You then observe that section until it is completely retrieved.

In the case of monitoring long sections you must treat the half sections sampled as you would whole short sections, i.e., record the number of tans or poks in the half section

monitored on your data form as you would record the number of tans or poks for a short or typical length Japanese squid driftnet section. For example, if 5 sections, each consisting to 250 poks (tans) were set and you sampled 7 half sections, then the number of poks (tans) per section recorded on the data form should be 125, not 250. The operation you monitored would be considered to have consisted of 10 sections of 125 poks (tans) or a total length of 1,250 poks (tans) of driftnet set.

Step 2. Collect Start of Retrieval Location/Time Data

. These data (Month, Day, Time, Latitude, Longitude, Sea Surface Temperature) are collected at the beginning of the retrieval of the first section (not the first section monitored). You may need to collect the data directly or it may be made available if the bridge watch is maintaining the Bridge Log.

. Note whether you started the retrieval by picking up the first or last section set.

Step 3. Retrieval Monitoring (What to Count)

. What observations you record will differ slightly if you are required to record additional dropout and shakeout data for a section. Only 2 sections per operation will require additional counting of dropouts and shakeouts.

. Dropouts for most marine fish are only counted in those sections specifically designated for dropout monitoring.

. For all sections that do not require dropout monitoring, you will record the following information for each section:

DECKED	the numbers of animals by species of SQUID AND FISH that come over the rail onto the deck (this does not include catch in the dropout catcher).
DEAD	the numbers of animals by species of BIRDS, MAMMALS, AND TURTLES entangled which show no signs of life whether they make it on deck or not.

ALIVE — the numbers of animals by species of entangled BIRDS, MAMMALS, AND TURTLES which become entangled or are released alive and are thought to have a high probability of survival.

Momentary entanglements occur alongside the vessel, at the point where the driftnet is being hauled out of the water onto the deck. Fur seals often swim above the net at this location, and sometimes become entangled in the loose bight of webbing formed between the corkline and leadline. The crew then slacks the corkline and hand-hauls webbing from the leadline, thus releasing the seal within seconds and while it is still in the water.

UNKNOWN — the numbers of animals by species of entangled BIRDS, MAMMALS, AND TURTLES whose fate is unknown PLUS the number that, having been released or fallen from the net, are still alive but are likely to die soon.

CATCH LOG

VESSEL IKA MARU #7 OPERATION NO. 8

<--Squid and Fish----------SPECIES----------Birds and Mammals-->

SEC	TIME	010 N.F. Squid	223 Pac. Pomfret	102 Blue Shark	122 Sickfish	224 Pelagic Stm.	121 Albac.	103 Salm. Shark					720 WRN. Dol.	431 N Fulmar	COMMENTS
1	2202	8	12	1	Γ										
1	2220	27	16			1	1								2234 Fur Seal along Corks.
1	2235	48	37				Γ							D	
1	2250	57	48	1			1								2300 Seal left
1	2305	77	53												
T	2315	77	53	2	2	1	4							D=1	
2	2320	47	33				ØΓ								
2	2339	65	47	Γ	Π		ØØΠ						D		2350 Along cork line ½ body thru net Heavy entangle.
2	2358	142	73	1			ØΓ	1							
2	0016	241	125				1								
2	0032	303	400	Γ											Daybreak
T	0042	303	400	5	3		28	1					D=1		

Start each operation on a new page. Use about 5 lines/section.

CATCH LOG

VESSEL La Mania #7 OPERATION NO. 8

<--Squid and Fish----------SPECIES----------Birds and Mammals-->

SEC	TIME	223 Bonnet	102 Bl. Shark	121 BLBA	122 Skipjack	231 Cowcod	010 NP Squid							475 Tail Patch	COMMENTS
40	1552	16/10	M D												
40	2007	19/20		M DDD											
40	2200	20/40												D	
40	2339	36/53	DD	1 D											
40	2533	88/79													
T	0310	88/79	3/3	4/4										D	
5	0315	3				1	63								
5	0330	6		B1			92								
5	0348	24	F				106								
5	0401	25					210								
5	0415	32					242								
T	0425	32	2	6		1	242								

Start each operation on a new page. Use about 5 lines/section.

CATCH LOG

VESSEL IKA-MARU #7 OPERATION NO. 8

<--Squid and Fish----------SPECIES----------Birds and Mammals-->

SEC	TIME	NF 010 SQUID	P. 223 Pomfret	050 ?Salmon	122 Skipjack									458 ?DK. S/W	COMMENTS
6	0430	16	2												
6	0450	39	12												
6	0459	57	12	1											
T	0520	57	12	050 1											Salmon i.d. a 052 on deck
7D	0530		2/2												
7D	0545		2/6		DD									D	
7D	0600		2/8											AA 4	
7D	0610		2/9												
T	0620		2/9		0/2									D=1 A=2 U=1	i.d. as 456 later on dead bird.

Start each operation on a new page. Use about 5 lines/section.

Step 4. The counting and recording of catch (How to count them)

. Remember, the objective is to count animals according to the rules of Step 3 (above) such that you obtain totals by net section. For BIRDS, MAMMALS, AND TURTLES you count totals by section for DEAD, ALIVE, and UNKNOWN. For SQUID AND FISH, you count the numbers landed on deck for most sections. The exception is when you are monitoring a section for dropouts as instructed in Step 6.

. Animal counts are first recorded on the water resistant Catch Log forms provided.

. Each evening, after setting, put enough of these data sheets on a clipboard, collect pencils and counters and be ready to go to your catch monitoring position.

. Make sure you have enough space to complete a section on one side of the form. Always start an operation on a new page.

. Zero your counters at the beginning of each section.

. It is easier to use the counters for the most abundant species ... normally squid and pomfret. If you have a multiple counter, blue shark and albacore can be counted mechanically as well.

. The Catch Log is set up with some header information at the top (please be sure to fill in this information as you aren't the only one looking at these data sheets) with the columns for species across the page. You fill in the appropriate species for the columns as they come up in the nets. Allocate the left-most columns for squid and fish and the right-most columns for seabirds and mammals; if you are running out of columns you can use one column for miscellaneous species. For the Catch Log, you can use the species code or the species name. The species codes are essential when you fill out the Data Entry form(s) at the end of the retrieval.

. The retrieval of one section takes about an hour. Observers have found it easier to break that hour up into smaller blocks of time. After 10-20 minutes of recording, whatever is convenient, record the time on the line at the far left hand side of the page.

. Record the cumulative numbers of animals at the end of each interval. That is, at the end of each interval write down the number on the counter. This way, you have the total number of squid for the section on the counter.

. Start counting the next block.

. REMEMBER: For sections not monitored do not collect any data, specimens, or biological samples.

. If time permits you should record information associated with marine mammal, seabird, and sea turtle entanglements and sightings of net debris as instructed in section 3.2.4 and 3.2.5

Step 5. Problems and errors in counting

Things don't always go as planned. Your counter may jam, your brain may overload or some other anomaly may occur. Here is what to do on these occasions.

. Make a comment on the Catch Log to indicate which time blocks are in error or have a problem.

. As soon as you discover a problem record the time, zero the counters, if necessary, and move on to the next time block.

. Make a record in your Trip Report noting the operation number, the section number, and fully document the nature of the problem.

. Keep these data sheets separate so that you can discuss them during debriefing.

Step 6. The counting and recording of DROPOUTs

. For the 2 randomly selected sections, you count BIRDS, MAMMALS AND TURTLES as usual. For these 2 sections, you DON'T COUNT SQUID so that you can spend your time counting the numbers of DECKED and DROPOUTS and SHAKEOUTS of FISH as well.

. For these two sections, the observer will count the numbers of fish by species DECKED (as above) and the number of fish DROPOUTs. DROPOUTs include fish that dropout and those that are shaken out before making it over the rail. To provide the observer with sufficient time to monitor fish dropouts and shakeouts, SQUID numbers should not be recorded for these two sections. Counts of decked and dropout pomfret can also be excluded if reliable observation of other species is difficult.

. Sections monitored for dropouts should by indicated by the section number followed by a "D" on the Catch Log form.

. Remember, you are recording every BIRD, MAMMAL, OR TURTLE that is caught in the net under one of the categories: DEAD, ALIVE, or UNKNOWN so this step only relates to FISH.

. Unfortunately, for these 2 sections, your eye needs to be in many places at once. You count DECKED fish as DECKED as you have in all other sections. Observable dropouts and shakeouts occur anywhere from the time the net breaks the ocean surface until it comes over rail of the vessel.

. On some occasions, you'll have trouble counting DECKED and DROPOUTs of pomfret. If you find there are so many pomfret in the catch and dropout that your mind is somewhat boggled by them, then you can treat pomfret like squid for this section i.e. you don't need to count them for this section.

. FOR THOSE 2 SECTIONS PER OPERATION WHERE YOU MONITORED FISH DROPOUTS AS WELL AND DID NOT COUNT SQUID, ENTER -1 (MINUS ONE) AS THE SQUID COUNT FOR THE APPROPRIATE SECTION ON THE DATA FORM (CJ90 for Canada and Japan, Form 2 for the U.S.). IF YOU CHOSE NOT TO COUNT POMFRET FOR THAT SECTION, RECORD -1 AS THE POMFRET CATCH FOR THAT SECTION AS WELL. When analyzing the data, we will use -1 in the squid catch field to identify each section that was monitored for fish dropouts.

Step 7. Between Monitored Sections

Once the section of net is on board the vessel and the working deck is free of net, you should go down on deck and examine the bycatch set aside by the crew. If there are only a couple of birds, mammals, or fish you can probably make a positive identification before starting the retrieval of the next section of net. If you have several birds or other species and will not have time to identify all of them you should label a basket with the section number and place the specimens in it so that you can process them after the next section is retrieved, or at the end of the haul. If the animals will not fit in a basket then find some place to temporarily store them until you have a opportunity to process them. It will be best to discuss this procedure with the fishing master and captain at the precruise meeting so that the crew is not suddenly surprised during a retrieval. The important point here is to associate the specimens with the correct section number so that you can complete the catch log by species or taxonomic group for each section of net retrieved.

Step 8. After the Last Section

. Record the following data from the Bridge Log or instruments: End of retrieval - month, day, time, latitude, longitude, sea surface temperature, Beaufort scale, Wind direction and Swell height

Step 9. Finish any biological sampling or species identifications

Step 10. Fill out the appropriate Data Forms.

3.2.4 Net Debris

Any netting that comes up in the driftnet must be noted in the catch log. Record the type, color, mesh size and presence or absence of marine organisms attached to or entangled in it. Similarly, if a piece is seen nearby, but not caught in the net make the same notations.

3.2.5 Entanglements

Marine mammal:

As soon as a marine mammal entanglement is observed ahead of the vessel, the observer should concentrate on the animal's movements, if any, before it comes aside and is lifted from the water. The observer should note in the catch log:

- where in the net (i.e., top, middle, bottom) the animal is entangled,
- the approximate length of the animal (in centimeters),
- whether it was a dalli or a truei color type for Dall's porpoise, and,
- if a northern fur seal, what was the whisker color and were ear tags seen.

Describe the entanglement as to heavy, medium, light.

Seabirds:

Seabird entanglements are generally seen as the driftnet emerges from the water just before it comes over the rail. The observer should identify the species or make a list of characteristics, in the rite-in-rain notebook, if identification is not possible. If time allows, record its vertical position in the net (upper, middle or lower 1/3) and its condition if released alive. Each seabird entanglement should be considered a separate event, unless two or more come up less than a minute apart.

Sea Turtles:

Sea turtle entanglements are logged by simple tally. The condition of turtles released alive, however, should be noted in the rite-in-rain notebook. Identification may be difficult, so always list identification characteristics.

3.2.6 Species Code List

CEPHALOPODS

001	Unidentified Squid	NA
002	Other Identified Squid	
010	Neon Flying Squid	Ommastrephes bartrami
011	Eight-armed Squid	Gonatopsis borealis
012	Boreal Clubhook Squid	Onchoteuthis borealijaponica
013	Purpleback Flying Squid	Stenoteuthis oulaniensis
014	Luminous Flying Squid	Eucleoteuthis luminosa
015	Schoolmaster Gonate Squid	Berryteuthis magister

SALMONIDS

050	Unidentified Salmonid	Oncorhynchus spp.
051	Chinook	Oncorhynchus tsawytscha
052	Chum	O. keta
053	Coho	O. kisutch
054	Pink	O. gorbuscha
055	Sockeye	O. nerka
056	Steelhead	O. mykiss

MARINE FISHES

Sharks

101	Unidentified shark	
102	Blue	Prionace glauca
103	Salmon	Lamna ditropis
104	Common Thresher	Alopias vulpinus
105	Short-finned Mako	Isurus oxyrinchus
106	Cookie-cutter	Isistius brasiliensis
107	Pygmy	Euprotomicrus bispinatis

Rays

115	Unidentified	
116	Pelagic Stingray	Dasyatis violacea
117	Diamond Stingray	Dasyatis brevis

Tunas

120	Unidentified Tuna	
121	Albacore	Thunnus alalunga
122	Skipjack	Katsuwonus pelamis
123	Northern Bluefin	Thunnus thynnus
124	Bigeye	Thunnus obesus
125	Yellowfin	Thunnus albacares
126	Bullet Tuna (Bullet Mackerel)	Auxis rochei
127	Black Skipjack	Euthynnus lineatus
128	Kawakawa	Euthynnus affinis
129	Pacific Bonito	Sarda chiliensis
130	Pacific Mackerel	Scomber japonicus
131	Frigate Mackerel	Auxis thazard

Billfishes

140	Unidentified Billfish	
141	Swordfish	Xiphias gladius
142	Unidentified Marlin	
143	Striped Marlin	Tetrapturus audax
144	Pacific Blue Marlin	Makaira mazara
145	*Sailfish*	*Istiophorus platypterus*
146	Shortnose Spearfish	Tetrapturus angustirostris

Other Fin Fishes

190	Unidentified Fish	
195	Other Identified Fish (Observer records species in logbook; species code assigned by mutual agreement among programs at end of season)	
200	Unidentified Lancetfish/Daggertooth	
201	Longnose Lancetfish	Alepisaurus ferox
202	Daggertooth	Anotopterus pharao
203	Unidentified Flying Fish	
204	California Flying Fish	Cypselurus californicus
205	Pacific Saury	Cololabis saira
206	Opah	Lampris guttatus
207	Unidentified "Ribbonfish"	
208	Crestfish	Lophotus lacepede
209	Whiptail Ribbonfish	Desmodema lorum
210	Lowsail Ribbonfish	Trachipterus ishikawae
211	Tapertail Ribbonfish	Trachipterus fukuzakii
212		Trachipterus trachypterus
213	King-of-the-Salmon	Trachipterus altivelis
214	Scalloped Ribbonfish	Zu cristatus

215	Oarfish	Regalecus glesne
216	Skilfish	Erilepis zonifer
217	Pilotfish	Naucrates ductor
218	Unidentified Jack Fish	
219	Jackmackerel	Trachurus symmetricus
220	Yellowtail	Seriola lalandi
221	Mahi Mahi	Coryphaena hippurus
222	Unidentified Pomfret	
223	Pacific Pomfret	Brama japonica
224	Pelagic Armourhead	Pseudopentaceros wheeleri
225	Wahoo	Acanthocybium solandri
226	Pacific Barracuda	Sphyraena argentea
227	Snake Mackeral	Gempylus serpens
228	Escolar	Lepidocybium flavobrunneum
229	Oilfish	Ruvettus pretiosus
230	Smalleye Squaretail	Tetragonurus cuvieri
231	Louvar	Luvarus imperialis
232	Unidentified Ragfish/Medusafish	
233	Ragfish	Icosteus aenigmaticus
234	Medusafish	Icychthys lockingtoni
235	Black Durgon	Melichthys niger
236	Redtail Triggerfish	Xanthichthys mento
237	Oceanic Puffer	Lagocephalus lagocephalus
238	Ocean Sunfish	Mola mola
239	Slender Mola	Ranzania laevis
250	Blackrag	Psenes pellucidus
251	Longfin dragonfish	Tactostoma macropus

MARINE BIRDS

400	Unidentified Bird	Aves
401	Other Identified Bird	

(Observer records identification in logbook; species code assigned by mutual agreement among progams at end of season)

Loons and Grebes

405	Unidentified Loon (Diver)	Gaviidae
406	Yellow-billed Loon (White-bellied Diver)	Gavia adamsii
407	Common Loon (Great Northern Diver)	Gavia immer
408	Arctic Loon (Black-throated Diver)	Gavia pacifica (Formerly arctica)
409	Red-throated Loon (Red-throated Diver)	Gavia stellata

410	Unidentified Grebe	
411	Little Grebe	Tachybaptus ruficollis
412	Pied-billed Grebe	Podilymbus podiceps
413	Red-necked Grebe	Podiceps grisegena
414	Horned Grebe	Podiceps auritus
415	Black-necked Grebe (Eared)	Podiceps nigricollis
416	Great Crested Grebe	Podiceps cristatus
417	Western Grebe	Aechmorphorus occidentalis

Tubenoses (Procellariiformes; albatrosses, petrels, shearwaters, and storm petrels)

Albatrosses

420	Unidentified Albatross	Diomedeidae
421	Laysan Albatross	Diomedea immutabilis
422	Short-tailed Albatross	Diomedea albatrus
423	Black-footed Albatross	Diomedea nigripes
424	Black-browed Albatross	Diomedea melanophris

Fulmars/Petrels

430	Unidentified Fulmar/Petrel	
431	Northern Fulmar	Fulmarus glacialis
432	Solander's Petrel (Providence)	Pterodroma solandri
433	Kermadec Petrel	Pterodroma neglecta
434	Murphy's Petrel	Pterodroma ultima
435	Herald Petrel (Trinidade)	Pterodroma arminjoniana
436	Phoenix Petrel	Pterodroma alba
437	Tahiti Petrel	Pterodroma rostrata
438	Juan Fernandez Petrel (White-necked)	Pterodroma externa
439	Dark-rumped Petrel (Hawaiian)	Pterodroma phaeopygia
440	Mottled Petrel	Pterodroma inexpectata
441	Bonin Petrel	Pterodroma hypoleuca
442	Cook's Petrel	Pterodroma cookii
443	Black-winged Petrel	Pterodroma nigripennis
444	Stejneger's Petrel (Pycroft's)	Pterodroma longirostris
445	White-winged Petrel (Gould's)	Pterodroma leucoptera
446	Bulwer's Petrel	Bulweria bulwerii

Shearwaters

450	Unidentified Shearwater	
451	Streaked Shearwater	Calonectris leucomelas

452	Pink-footed Shearwater (Flesh-footed)	Puffinus creatopus
453	Pale-footed Shearwater (Flesh-footed)	Puffinus carneipes
454	Wedge-tailed Shearwater	Puffinus pacificus
455	Buller's Shearwater (New Zealand)	Puffinus bulleri
456	Sooty Shearwater	Puffinus griseus
457	Short-tailed Shearwater (Slender-billed)	Puffinus tenuirostris
458	Unidentified dark shearwater (Sooty or Short-tailed)	P. griseus/tenuirostris
459	Christmas Shearwater	Puffinus nativitatis
460	Newell's Shearwater (Townsend's)	Puffinus auricularis
461	Audubon's Shearwater	Puffinus lherminieri

Storm-Petrels

470	Unidentified Storm-Petrel	Hydrobatidae
471	Wilson's Storm-Petrel	Oceanites oceanicus
472	Band-rumped Storm-Petrel (Madeiran) (Harcourt's)	Oceanodroma castro
473	Leach's Storm-Petrel	Oceanodroma leucorhoa
474	Swinhoe's Storm-Petrel	Ocenaodroma monorhis
475	Fork-tailed Storm-Petrel	Oceanodroma furcata
476	Tristram's Storm-Petrel (Sooty)	Oceanodroma tristrami
477	Matsudaira's Storm-Petrel	Oceanodroma matsudairae

Pelicans and allies (pelicans, tropicbirds, boobies, cormorant, frigatebirds)

500	Unidentified Pelican or ally	Pelecaniformes
501	Unidentified tropicbird	Phaethontidae
502	Red-tailed Tropicbird	Phaethon rubicauda
503	White-tailed Tropicbird	Phaethon lepturus
504	Unidentified Booby	Sulidae
505	Masked Booby (Blue-faced)	Sula dactylatra
506	Brown Booby	Sula leucogaster
507	Red-footed Booby	Sula sula
508	Unidentified Cormorant	Phalacrocoracidae
509	Double-crested Cormorant	Phalacrocorax auritus
510	Brandt's Cormorant	Phalacrocorax penicillatus
511	Pelagic Cormorant	Phalacrocorax pelagicus
512	Red-faced Cormorant	Phalacrocorax urile

513	Great Cormorant (Common)	Phalacrocorax carbo
514	Japanese Cormorant (Temminck's)	Phalacrocorax capillatus
517	Unidentified Frigatebird	Fregatidae
518	Great Frigatebird	Fregata minor
519	Lesser Frigatebird	Fregata ariel

Shorebirds

Phalaropes

520	Unidentified Phalarope	Phalaropodinae
521	Red Phalarope (Grey)	Phalaropus fulicaria
522	Northern Phalarope (Red-necked)	Phalaropus lobatus
523	Wilson's Phalarope	Phalaropus tricolor

Gulls and allies (skuas, jaegers, gulls, terns, noddies, and alcids)

Skua/Jaegers

524	Unidentified skua/jaeger	Stercorariinae
525	South polar Skua	Catharacta maccormicki
526	Pomarine skua/jaeger	Stercorarius pomarinus
527	Parasitic skua/jaeger (Arctic)	Stercorarius parasiticus
528	Long-tailed skua/jaeger	Stercorarius longicaudus

Gulls

530	Unidentified gull	Larinae
531	Black-tailed Gull (Japanese)	Larus crassirostris
532	Ring-billed Gull	Larus delawarensis
533	Common Gull (Mew)	Larus canus
534	Herring Gull	Larus argentatus
535	Thayer's Gull	Larus thayeri
536	California Gull	Larus californicus
537	Western Gull	Larus occidentalis
538	Slaty-backed Gull	Larus schistisagus
539	Glaucous-winged Gull	Larus glaucescens
540	Glaucous Gull	Larus hyperboreus
541	Franklin's Gull	Larus pipixcan
542	Black-headed Gull	Larus ridibundus
543	Bonaparte's Gull	Larus philadelphia
544	Little Gull	Larus minutus
545	Black-legged Kittiwake	Rissa tridactyla
546	Red-legged Kittiwake	Rissa brevirostris
547	Sabine's Gull	Larus sabini

548	Ross's Gull	Rhodostethia rosea
549	Ivory Gull	Pagophila eburnea
Terns, Noddies		
555	Unidentified Tern	Sterninae
556	Common Tern	Sterna hirundo
557	Aleutian Tern	Sterna aleutica
558	Arctic Tern	Sterna paradisaea
559	Grey-backed Tern (Spectacled Tern)	Sterna lunata
560	Sooty Tern	Sterna fuscata
561	Crested Tern (Swift)	Sterna bergii
562	Caspian Tern	Sterna caspia
563	Blue-grey Noddy (Grey)	Procelsterna cerulea
564	Brown Noddy (Common)	Anous stolidus
565	Black Noddy (Lesser)	Anous tenuirostris
566	White Tern (Fairy)	Gygis alba
Alcids		
570	Unidentified alcid	Acidae
571	Unidentified Murre	Uria sp.
572	Thick-billed Murre (Brunnich's Guillemot)	Uria lomvia
573	Common Murre (Guillemot)	Uria aalge
574	Unidentified Guillemot	Cepphus
575	Black Guillemot	Cepphus grylle
576	Pigeon Guillemot	Cepphus columba
577	Spectacled Guillemot (Sooty Guillemot)	Cepphus carbo
578	Unidentified Murrelet	
579	Marbled Murrelet	Brachyramphus marmoratus
580	Kittlitz's Murrelet	Brachyramphus brevirostris
581	Ancient Murrelet	Synthliboramphus antiquum
582	Crested Murrelet (Japanese)	Synthliboramphus wumizusume
583	Unidentified Auklet	
584	Cassin's Auklet	Ptychoramphus aleuticus
585	Parakeet Auklet	Cyclorrhynchus psittacula
586	Crested Auklet	Aethia cristatella
587	Least Auklet	Aethia pusilla
588	Whiskered Auklet	Aethia pygmaea

589	Rhinoceros Auklet	Cerorhinca monocerata
590	Unidentified Puffin	Fratercula sp.
591	Horned Puffin	Fratercula corniculata
592	Tufted Puffin	Fratercula cirrhata

MARINE MAMMALS

Pinnipeds

700	Unidentified Pinniped	NA
701	Northern Fur Seal	Callorhinus ursinus
702	Northern Sea Lion	Eumetopias jubatus
703	Elephant Seal	Mirounga angustirostris
704	Harbor Seal	Phoca vitulina
705	Ribbon Seal	Phoca fasciata

Cetaceans

710	Unidentified Dolphin/Porpoise	NA
711	Dall's Porpoise, type unknown	Phocoenoides dalli
712	Dall's Porpoise, dalli type	" "
713	Dall's Porpoise, truei type	" "
714	Dall's Porpoise, black type	" "
715	Harbor Porpoise	Phocoena phocoena
720	Northern Right Whale Dolphin	Lissodelphis borealis
721	Pacific White-sided Dolphin	Lagenorhynchus obliquidens
722	Common Dolphin	Delphinus delphis
723	Striped Dolphin	Stenella coeruleoalba
724	Spinner Dolphin, type unknown	Stenella longirostris
725	Hawaiian Spinner	" "
726	Whitebelly Spinner	" "
727	Eastern Spinner	" "
728	Spotted Dolphin	Stenella attenuata
729	Fraser's Dolphin	Lagenodelphis hosei
730	Bottlenose Dolphin	Tursiops truncatus
731	Rough-toothed Dolphin	Steno bredanensis
732	Risso's Dolphin	Grampus griseus
735	Kogia, unidentified	Kogia, spp.
736	Pygmy Sperm whale	Kogia breviceps
737	Dwarf Sperm Whale	Kogia simus
740	Unidentified Black Whale ("Blackfish")	
741	Melon-headed Whale	Peponocephala electra
742	Pygmy Killer Whale	Feresa attenuata
743	False Killer Whale	Psuedorca crassidens

745	Short-finned Pilot Whale	Globicephala macrorhynchus
746	Killer Whale	Orcinus orca
750	Unidentified Beaked Whale	NA
751	Baird's Beaked Whale	Berardius bairdii
752	Southern (?) Bottlenose Whale	Hyperoodon spp.
753	Cuvier's Beaked Whale	Ziphius cavirostris
755	Unidentified Mesoplodon	Mesoplodon, spp.
756	Hubb's	M. carlhubbsi
757	Stejneger's	M. stejnegeri
758	Blainville's	M. densirostris
759	Ginko-toothed	M. ginkgodens
760	Hector's	M. hectori
770	Unidentified Large Whale	NA
771	Blue Whale	Balaenoptera musculus
772	Fin Whale	B. physalus
773	Sei Whale	B. borealis
774	Bryde's Whale	B. edeni
775	Minke Whale	B. acutorostrata
776	Humpback Whale	Megaptera novaeangliae
777	Bowhead whale	Eubalaena glacialis
778	Right Whale	Balaena mysticetus
779	Grey Whale	Eschrichtius robustus
780	Sperm Whale	Physeter macrocephalus

SEA TURTLES

900	Unidentified Sea Turtle	
901	Leatherback	Dermochelys coriacea
902	Loggerhead	Caretta caretta
903	Green	Chelonia mydas
904	Olive Ridley	Lepidochelys olivacea
905	Hawksbill	Eretmochelys imbricata

DRIFTNET OBSERVER DATA FORMS
DEFINITIONS OF VARIABLES AND DATA CODING INSTRUCTIONS
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DRIFTNET OBSERVER DATA FORM 1 (1990)
OPERATION - GEAR - ENVIRONMENTAL CONDITIONS

VARIABLE	FIELDS	DEFINITIONS AND INSTRUCTIONS
VESSEL NAME	-	Include Vessel numbers, e.g., HOYO MARU NO. 32
OBSERVER	-	Use full Name.
FORM	1	Data record identifier.
SOURCE	2	Nationality of observer completing form: A = USA, C = Canadian, J = Japanese, K = Korean, T = Republic of China (CCNAA).
NATION	3	Host nation of observed vessel: J = Japan, K = Republic of Korea, T = Republic of China (CCNAA).
FISHERY	4	Type of gear: S = squid, L = large mesh.
LICENSE N0.	5-7	Driftnet fishery licence number, issued to vessel by fishery agency of the host nation.
OPE. NO.	8-10	The sequential number of the fishing operation during the cruise starting when the observer boards the vessel. An operation consists of the entire process from the setting of the entire quantity of net to the subsequent retrieval of the net after one night of seaking. Operations during days not sampled are numbered.
YEAR	11-12	Last two digits of year, e.g., 90.
ACTIVITY	13	Daily activity of observer during the cruise. A form 1 should be filled out for each day at sea, beginning with the first operation observed. Activity codes are: O = operation observed, T = vessel in transit, S = storm (no fishing), N = not observed.
SET DIRECTION	14-16	Vessels true heading at beginning of net set (360°)

STRAIGHT?	17	Yes = Y, direction of set did not vary by more than 45° from a single direction. No = N, set direction varied by more than 45°, or net set in two or more parallel lines.
NO.SECTIONS	18-19	The total number of sections deployed during current operation. NO. VESSELS20-21The number of driftnet vessels within 15 nm of the observed vessel at the start of the set, regardless of nationality.
RETRIEVAL START	22	Reference to which section of the operation is retrieved first, in relation to the order in which the section was set; F = first section set, L = last section set, O = other.
TIME ZONE	23-24	Recorded as time host vessel maintains. J = Japan, K = Republic of Korea, T = Republic of China (CCNAA). Second digit: D = Daylight, S = Standard.
MESH SIZE 1	25-27	Stretched mess (mm) of predominant fishing gear, i.e., that which comprises the majority of the net.
TAN LENGTH 1	28-29	Length at corks (m) of predominant fishing gear.
MATERIAL 1	30	Type of mesh material used for predominant fishing gear: 1 = Mono-filament, 2 = Multi-strand, 3 = Multi-filament (see manual for definitions).
DEPTH 1	31-32	Distance between corkline and leadline of predominant fishing gear when soaked at sea.
MESH SIZE 2	33-35	If more than one mesh size is used, the stretched mesh (mm) of the less prevalent size.
TAN LENGTH 2	36-37	If more than one tan length is used, the length (m) at corks of the less prevalent length.
MATERIAL 2	38	If more than one mesh material is used, the type of the less prevalent material. Coded as above.
DEPTH 2	39-40	Distance between corkline and leadline (when soaked at sea) of less prevalent gear, if more than one gear type is used.

ENVIRONMENTAL CONDITIONS: SET OPERATION

START OF SET	-	The time at which gear is first deployed to begin net setting operation.
SST	41-43	Sea surface temperature. Recorded in tenths of degrees centigrade.
WIND FORCE/	45	Sea surface conditions using the Beaufort scale, 0-9.
DIRECTION	46-48	True bearing from which wind is coming (360°).
SWELL HT.	49-50	The estimated swell height, to the nearest whole meter.
END OF SET	-	The time at which setting operation is completed, i.e., last gear is deployed.
SST	51-53	Sea surface temperature (°C)

ENVIRONMENTAL CONDITIONS: RETRIEVAL OPERATION

START	-	The time at which net end is first brought on board to begin net retrieval operation.
SST	54-56	Sea surface temperature (°C)
END	-	The time at which last of net is brought on board to complete the retrieval operation.
SST	57-59	Sea surface temperature (°C)
WIND FORCE/	60	Beaufort wind force, 0-9.
DIRECTION	61-63	True bearing (360°) from which wind is coming.
SWELL HT.	64-65	The estimated swell height, to the nearest whole meter.

BEGIN/END SET OPERATION DATA

MO DAY	66-69	Start of set month and day, ships time.
TIME	70-73	Start of set, ships time (24 hour clock).
MO DAY	74-77	End of set month and day, ships time.
TIME	78-81	End of set, ships time (24 hour clock).

LAT (N)	82-85	Start set latitude, to the nearest minute. North assumed.
LONGITUDE	86-91	Start set longitude, to the nearest minute. Circle one: E = east, W = west.
LAT (N)	92-95	End set latitude, to the nearest minute, north assumed.
LONGITUDE	96-101	End set longitude, to the nearest minute. Circle one: E = east, W = west.

START/END RETRIEVAL OPERATION DATA

MO DAY	102-105	Start of retrieval month and day, ships time.
TIME	106-109	Start of retrieval, ships time (24 hour clock).
MO DAY	110-113	End of retrieval month and day, ships time.
TIME	114-117	End or retrieval, ships time (24 hour clock).
LAT (N)	118-121	Start of retrieval latitude, north assumed.
LONGITUDE	122-127	Start of retrieval longitude, circle E or W
LAT (N)	128-131	End of retrieval latitude, north assumed.
LONGITUDE	132-137	End of retrieval longitude, circle E or W.

DRIFTNET OBSERVER DATA FORM 1 (1990)

VESSEL NAME	OBSERVER	FORM	SOURCE	NATION	FISHERY	LICENSE NO.	OPE. NO.	YEAR
IKA MARU	A. L. KANE	1	A	J	S	777	008	90
		1	2	3	4	5-7	8-10	11 12

ACTIVITY
0
13

SET DIRECTION	STRAIGHT?	NO. SECTIONS	NO. VESSELS	RETRIEVAL START
090 ° TRUE	Y Y/N	02	06	F F/L
14-16	17	18 19	20 21	22

TIME ZONE
JS
23 24

MESH SIZE 1	TAN LENGTH 1	MATERIAL 1	DEPTH 1
115 mm	48 m	1	10 m
25-27	28 29	30	31 32

MESH SIZE 2	TAN LENGTH 2	MATERIAL 2	DEPTH 2
mm	m		m
33-35	36 37	38	39 40

ENVIRONMENTAL CONDITIONS: SET OPERATION

START				END
SST	WIND FORCE/DIR		SWELL HT.	SST
156 °C	2 BEAU	100 °	01 m	161 °C
41-43	44	45-47	48 49	50-52

ENVIRONMENTAL CONDITIONS: RETRIEVAL OPERATION

START	END			
SST	SST	WIND FORCE/DIR		SWELL HT.
162 °C	159 °C	2 BEAU	265 °	01 m
53-55	56-58	59	60-62	63 64

START OF SET		
MO	DAY	TIME
06	07	1520
65-68		69-72

END OF SET		
MO	DAY	TIME
06	07	1900
73-76		77-80

START OF RETRIEVAL		
MO	DAY	TIME
06	07	2202
101-104		105-108

END OF RETRIEVAL		
MO	DAY	TIME
06	08	0612
109-112		113-116

LAT (N)	LONGITUDE
3934	1794 5 E/W
81-84	85-90

LAT (N)	LONGITUDE
3930	1793 9 E/W
91-94	95-100

LAT (N)	LONGITUDE
3935	1794 1 6 E/W
117-120	121-126

LAT (N)	LONGITUDE
3929	1794 1 3 E/W
127-130	131-136

DRIFTNET OBSERVER DATA FORM 2 (1990)
SQUID - MARINE FISH - SALMON

VARIABLE	FIELD	DEFINITIONS AND INSTRUCTIONS
FORM	1	Data record identifier.
(HEADER)	2-12	Repeat of variables SOURCE through YEAR. Links data records for each operation.
SEC. NO.	13-14	Section number, sequential number of section hauled during retrieval operation, including sections not observed.
FL	15	Flag; section was observed = Y, section was not observed = N, Section was not retrieved = L.
# OF TANS	16-19	The total number of tans deployed for the section. Also recorded for non-observed sections.
TAN LGT	20-21	Tan length during observed section.
MESH SIZE	22-24	Stretched mesh size (mm) of observed section.
MA	25	Type of net material used in observed section. 1 = Mono-filament, 2 = Multi-strand, 3 = Multi-filament.
SD	27	Subsurface depth; distance (m) between ocean surface and top of mesh.
<u>SQUID</u>		
SPP	28-30	Three digit code particular to species.
NUMBER	31-34	The total number of squid decked during the observed section.
<u>MARINE FISH</u>		
SPP	35-37	Three digit code particular to species.
DECKED	38-42	The total numbers coming over the rail and onto the deck of the vessel.
DROPOUT	43-46	The number of animals by species, including those shaken out, <u>before</u> making it over the rail to the deck of the vessel. Animals caught in the dropout catcher are included as part of the dropout.

TOTAL	47-51	Sum of number decked and number dropped out during observed section.
SALMON		
SPP	52-54	Three digit code particular to species.
DECKED	55-58	Decked as defined with marine fish.
DPOUT	59-61	Decked as define with marine fish.
TOTAL	62-65	Sum of number decked and number dropped out during observed section.

DRIFTNET OBSERVER DATA FORM 2 (1990) SQUID - MARINE FISHES - SALMON

FORM	SOURCE	NATION	FISHERY	LICENSE NO.	OPE. NO.	YEAR
2	A	J	S	777	008	10
1	2	3	4	5-7	8-10	11 12

SEC NO.	FL	# OF TANS	TAN LGT	MESH SIZE1	MA	SD	SQUID SPP	SQUID NUMBER	MARINE FISHES SPP	MARINE FISHES DECKED	MARINE FISHES DROPOUT	MARINE FISHES TOTAL	SALMON SPP	SALMON DECKED	SALMON DPOUT	SALMON TOTAL
13 14	15	16-19	20 21	22-24	25	27	28-30	31-34	35-37	38-42	43-46	47-51	52-54	55-58	59-61	62-65
01	Y	0150	48	115	1	0	010	38	223	64		64				
									102	2		2				
									121	4		4				
									122	2		2				
01									224	1		1				
02							010	346	223	425		425				
									102	5		5				
									103	1		1				
									121	28		28				
02	Y	0150	48	115	1	0			123	3		3				
03	N															
04	Y	0150	48	115	1	0	010	1	223	106	123	229				
									102	3	3	6				
									121	4	4	8				
									123	1	1	5				
04							010	251	223	46		46				
05									102	2		2				
									121	6		6				
									122	1		1				
05									231	1		1				
06							010	66	223	24		24	052	1		1
07							010	1	223	12	10	22				
07	Y	0150	48	115	1	0			122	0	2	2				
08	N															

DRIFTNET OBSERVER DATA FORM 3 (1990)
MARINE MAMMALS - SEABIRDS - SEA TURTLES/OTHERS

VARIABLE	FIELDS	DEFINITIONS AND INSTRUCTIONS
FORM	1	Data record identifier.
(HEADER)	2-12	Repeat of variables SOURCE through YEAR. Links data records for each operation.
SEC. NO.	13-14	Section number. Sequential number of sections retrieved during current operation.
FL	15	Flag; Section was monitored Y = yes, N = no, L = not retrieved.
MARINE MAMMALS		
SPP	16-18	Species code: unique 3-digit code assigned to a particular species.
DEAD	19-21	The number of animals by species which show no signs of life whether they are brought on deck or not.
ALIVE	22-24	The number released alive of a particular species. Released alive is defined as those animals which showed signs of life and are thought to have a high potential of survival. Animals are either disentangled and released or tear free of the net. Northern fur seal momentary entanglements are not entered onto the coding forms.
UNKWN	25-27	The number by species of entangled animals whose fate is unknown PLUS the number that, having been released or fallen from the net, are still alive but are likely to die soon.
TOTAL	28-30	The sum of the dead, released alive, and unknown animals of a particular species within a section.
SEABIRDS		
SPP	31-33	Species code.
DEAD	34-36	The total number dead.
ALIVE	37-39	The total number released alive.
UNKWN	40-42	The total that were neither dead nor released alive.

TOTAL	43-45	The sum of dead, released alive, and unknown.

SEA TURTLES/OTHER

SPP	46-48	Species code.
DEAD	49-51	The total number dead.
ALIVE	52-54	The total number released alive.
UNKWN	55-57	The total that were neither dead nor released alive.
TOTAL	58-60	The sum of dead, released alive, and unknown.

DRIFTNET OBSERVER DATA FORM 3 (1990) MARINE MAMMALS - SEABIRDS - SEA TURTLES - OTHER

FORM	SOURCE	NATION	FISHERY	LICENSE NO.	OPE. NO.	YEAR
3	A	J	S	777	008	90
1	2	3	4	5-7	8-10	11 12

SEC NO. 13 14	FL 15	MARINE MAMMALS SPP 16-18	DEAD 19-21	ALIVE 22-24	UNKWN 25-27	TOTAL 28-30	SEABIRDS SPP 31-33	DEAD 34-36	ALIVE 37-39	UNKWN 40-42	TOTAL 43-45	SEA TURTLES / OTHER SPP 46-48	DEAD 49-51	ALIVE 52-54	UNKWN 55-57	TOTAL 58-60
01	Y						432	1	0	0	1					
02	Y	720	1	0	0	1										
03	N															
04	Y						475	1	0	0	1					
05	Y															
06	Y															
07	Y						456	1	0	0	1					
07	Y						458	0	2	1	3					
02	N															

DRIFTNET OBSERVER DATA FORM 4 (1990)
CATCH SUMMARY

VARIABLE	FIELDS	DEFINITIONS AND INSTRUCTIONS
FORM	1	Data record identifier
(HEADER)	2-12	Repeat of variables SOURCE through YEAR. Links data records for each operation.
TANS SET	13-16	Total number of tans set for current operation.
TANS OBSERVED	17-20	Total number of tans observed while monitoring the net. Subset of tans set.
SQUID TAKEN.		COMMON NAMES OF SQUID SPECIES
CODE	21-23	Species code: unique code particular to species.
TOTAL	24-28	The total number of squid counted in the observed sections.
MARINE FISHES SPECIES TAKEN		COMMON NAMES OR MARINE FISH
CODE	29-31	Species code.
DECKED	32-36	The total number decked for observed sections.
DROPOUT	37-41	The total number which dropped out for observed sections.
TOTAL	42-46	The sum of the number decked and the number which dropped out for observed sections.
SALMON TAKEN		COMMON NAMES OF SALMONID SPECIES
CODE	47-49	Species code.
DECKED	50-53	The total number decked for observed sections.
DRPOUT	54-57	The total number which dropped out for observed sections.
TOTAL	58-61	The sum of the number decked and the number which dropped out for observed sections.

MARINE MAMMALS SPECIES TAKEN		COMMON NAMES OF MARINE MAMMAL
CODE	62-64	Species code.
DEAD	65-67	The total number dead for the observed sections.
ALVE	68-70	The total number released alive for the observed sections.
UNKN	71-73	The total number which were neither dead nor released alive for the observed sections.
TOT.	74-76	The sum of the number dead, released alive, and unknown for the observed sections.
SEABIRDS TAKEN		COMMON NAMES OF SEABIRD SPECIES
CODE	77-79	Species code.
DEAD	80-82	The total number dead for the observed sections.
ALVE	83-85	The total number released alive for the observed sections.
UNKN	86-88	The total number which were neither dead nor released alive for the observed sections.
TOT.	89-91	The sum of the number dead, released alive, and unknown for the observed sections.
TURTS/OTH. TURTLES/OTHERS TAKEN		COMMON NAMES OF SEA
CODE	92-94	Species code.
DEAD	95-97	The total number dead for the observed sections.
ALVE	98-100	The total number released alive for the observed sections.
UNKN	101-103	The total number which were neither dead nor released alive for the observed sections.
TOT.	104-106	The sum of the number dead, released alive, and unknown for the observed sections.

DRIFTNET OBSERVER DATA FORM 4 (1990) CATCH SUMMARY

FORM	SOURCE	NATION	FISHERY	LICENSE NO.	OPE. NO.	YEAR
4	A	J	S	777	098	90
1	2	3	4	5 6 7	8 – 10	11 12

TANS SET	TANS OBSERVED
13 – 16	17 – 20

MARINE FISHES	CODE 29–31	DECKED 32–36	DROPOUT 37–41	TOTAL 42–46
POMFRET	223	677	133	810
YELLOWTAIL				
BLUE SHARK	102	12	3	15
SALMON SHARK	103	1	0	1
ALBACORE TUNA	121	38	4	42
SKIPJACK TUNA	122	7	7	14
YELLOWFIN TUNA				
BIGEYE TUNA				
PELAGIC ARMHEAD	224	1	0	1
LOUVAR	231	1	0	1

MARINE MAMMALS	CODE 62–64	DEAD 65–67	ALVE 68–70	UNKN 71–73	TOT. 74–76
N. FUR SEAL					
DALL'S PORP.					
N. RT-WHALE D.	720	1	0	0	1
PAC WT-SIDE D.					

SEABIRDS	CODE 77–79	DEAD 80–82	ALVE 83–85	UNKN 86–88	TOT. 89–91
SOOTY SHR.	456	1	0	0	1
SHRT-TAIL SHR.					
UNID DARK SHR.	458	0	2	1	3
BLCK-FOOT ALB.					
LAYSAN ALB.					
N. FULMAR	431	1	0	0	1
FORK-TAIL S. PET.	475	1	0	0	1

SQUID	CODE 21–23	TOTAL 24–28
NEON FLY.	010	751
B-ARMED		
BRL. CLUB		

SALMON	CODE 47–49	DECKED 50–53	DRPOUT 54–57	TOTAL 58–61
UNID				
CHINOOK				
CHUM	052	1	0	1
COHO				
PINK				
SOCKEYE				
STEELHD				

TURTS/OTH.	CODE 92–94	DEAD 95–97	ALVE 98–100	UNKN 101 103	TOT. 104–106
UNID.					
LEATHER					
LOGGERHD					
GREEN					
O. RIDLEY					
HAWKSBILL					

3.2.8

Sampling Table
Operations with 7 sections

OPR.	SECTIONS TO OBSERVE							DROPOUT SEC.	
1	1	2	3	4	0	6	7	6	7
2	1	2	3	0	5	6	7	5	7
3	1	2	0	4	5	6	7	4	6
4	1	2	3	4	0	6	7	4	7
5	1	2	0	4	5	6	7	4	5
6	1	2	3	0	5	6	7	5	6
7	1	2	3	4	0	6	7	6	7
8	1	2	3	0	5	6	7	5	7
9	1	2	0	4	5	6	7	4	6
10	1	2	3	4	0	6	7	4	7
11	1	2	0	4	5	6	7	4	5
12	1	2	3	0	5	6	7	5	6
13	1	2	3	4	0	6	7	6	7
14	1	2	3	0	5	6	7	5	7
15	1	2	0	4	5	6	7	4	6
16	1	2	3	4	0	6	7	4	7
17	1	2	0	4	5	6	7	4	5
18	1	2	3	0	5	6	7	5	6
19	1	2	3	4	0	6	7	6	7
20	1	2	3	0	5	6	7	5	7
21	1	2	0	4	5	6	7	4	6
22	1	2	3	4	0	6	7	4	7
23	1	2	0	4	5	6	7	4	5
24	1	2	3	0	5	6	7	5	6
25	1	2	3	4	0	6	7	6	7
26	1	2	3	0	5	6	7	5	7
27	1	2	0	4	5	6	7	4	6
28	1	2	3	4	0	6	7	4	7
29	1	2	0	4	5	6	7	4	5
30	1	2	3	0	5	6	7	5	6
31	1	2	3	4	0	6	7	6	7
32	1	2	3	0	5	6	7	5	7
33	1	2	0	4	5	6	7	4	6
34	1	2	3	4	0	6	7	4	7
35	1	2	0	4	5	6	7	4	5
36	1	2	3	0	5	6	7	5	6
37	1	2	3	4	0	6	7	6	7
38	1	2	3	0	5	6	7	5	7
39	1	2	0	4	5	6	7	4	6
40	1	2	3	4	0	6	7	4	7
41	1	2	0	4	5	6	7	4	5
42	1	2	3	0	5	6	7	5	6
43	1	2	3	4	0	6	7	6	7
44	1	2	3	0	5	6	7	5	7
45	1	2	0	4	5	6	7	4	6
46	1	2	3	4	0	6	7	4	7
47	1	2	0	4	5	6	7	4	5
48	1	2	3	0	5	6	7	5	6
49	1	2	3	4	0	6	7	6	7
50	1	2	3	0	5	6	7	5	7
51	1	2	0	4	5	6	7	4	6
52	1	2	3	4	0	6	7	4	7
53	1	2	0	4	5	6	7	4	5
54	1	2	3	0	5	6	7	5	6
55	1	2	3	4	0	6	7	6	7
56	1	2	3	0	5	6	7	5	7
57	1	2	0	4	5	6	7	4	6
58	1	2	3	4	0	6	7	4	7

OPR.	SECTIONS TO OBSERVE							DROPOUT SEC.	
59	1	2	0	4	5	6	7	4	5
60	1	2	3	0	5	6	7	5	6
61	1	2	3	4	0	6	7	6	7
62	1	2	3	0	5	6	7	5	7
63	1	2	0	4	5	6	7	4	6
64	1	2	3	4	0	6	7	4	7
65	1	2	0	4	5	6	7	4	5
66	1	2	3	0	5	6	7	5	6
67	1	2	3	4	0	6	7	6	7
68	1	2	3	0	5	6	7	5	7
69	1	2	0	4	5	6	7	4	6
70	1	2	3	4	0	6	7	4	7
71	1	2	0	4	5	6	7	4	5
72	1	2	3	0	5	6	7	5	6
73	1	2	3	4	0	6	7	6	7
74	1	2	3	0	5	6	7	5	7
75	1	2	0	4	5	6	7	4	6
76	1	2	3	4	0	6	7	4	7
77	1	2	0	4	5	6	7	4	5
78	1	2	3	0	5	6	7	5	6
79	1	2	3	4	0	6	7	6	7
80	1	2	3	0	5	6	7	5	7
81	1	2	0	4	5	6	7	4	6
82	1	2	3	4	0	6	7	4	7
83	1	2	0	4	5	6	7	4	5
84	1	2	3	0	5	6	7	5	6
85	1	2	3	4	0	6	7	6	7
86	1	2	3	0	5	6	7	5	7
87	1	2	0	4	5	6	7	4	6
88	1	2	3	4	0	6	7	4	7
89	1	2	0	4	5	6	7	4	5
90	1	2	3	0	5	6	7	5	6
91	1	2	3	4	0	6	7	6	7
92	1	2	3	0	5	6	7	5	7
93	1	2	0	4	5	6	7	4	6
94	1	2	3	4	0	6	7	4	7
95	1	2	0	4	5	6	7	4	5
96	1	2	3	0	5	6	7	5	6
97	1	2	3	4	0	6	7	6	7
98	1	2	3	0	5	6	7	5	7
99	1	2	0	4	5	6	7	4	6
100	1	2	3	4	0	6	7	4	7
101	1	2	0	4	5	6	7	4	5
102	1	2	3	0	5	6	7	5	6
103	1	2	3	4	0	6	7	6	7
104	1	2	3	0	5	6	7	5	7
105	1	2	0	4	5	6	7	4	6
106	1	2	3	4	0	6	7	4	7
107	1	2	0	4	5	6	7	4	5
108	1	2	3	0	5	6	7	5	6
109	1	2	3	4	0	6	7	6	7
110	1	2	3	0	5	6	7	5	7
111	1	2	0	4	5	6	7	4	6
112	1	2	3	4	0	6	7	4	7
113	1	2	0	4	5	6	7	4	5
114	1	2	3	0	5	6	7	5	6
115	1	2	3	4	0	6	7	6	7
116	1	2	3	0	5	6	7	5	7
117	1	2	0	4	5	6	7	4	6
118	1	2	3	4	0	6	7	4	7
119	1	2	0	4	5	6	7	4	5
120	1	2	3	0	5	6	7	5	6

Sampling Table
Operations with 8 sections

OPR.	SECTIONS TO OBSERVE								DROPOUT SEC.	
1	1	2	0	4	5	0	7	8	7	8
2	1	2	3	0	5	6	0	8	5	8
3	1	0	0	4	5	6	7	8	4	6
4	1	2	3	4	0	6	7	0	4	7
5	1	2	3	0	5	6	0	8	6	8
6	1	0	0	4	5	6	7	8	4	8
7	0	2	3	4	0	6	7	8	4	6
8	1	2	0	4	5	6	7	0	4	7
9	1	2	3	4	0	0	7	8	4	7
10	1	0	0	4	5	6	7	8	4	6
11	1	2	3	4	0	0	7	8	7	8
12	1	0	3	0	5	6	7	8	5	6
13	1	2	0	4	5	6	0	8	4	6
14	1	2	3	0	5	0	7	8	5	8
15	1	0	3	4	0	6	7	8	6	7
16	0	2	3	0	5	6	7	8	5	8
17	1	2	0	4	5	0	7	8	5	7
18	1	2	3	4	0	6	0	8	4	6
19	1	0	3	4	5	0	7	8	5	7
20	1	2	3	4	0	6	0	8	4	8
21	1	0	0	4	5	6	7	8	5	8
22	1	2	3	0	0	6	7	8	6	8
23	1	0	3	4	5	0	7	8	4	5
24	1	2	3	4	0	6	7	0	4	6
25	0	2	0	4	5	6	7	8	6	8
26	1	2	3	4	0	0	7	8	4	8
27	1	2	0	4	5	6	7	0	6	7
28	1	2	3	4	0	0	7	8	7	8
29	0	2	0	4	5	6	7	8	4	6
30	1	2	3	0	0	6	7	8	6	7
31	1	2	0	4	5	6	7	0	5	7
32	1	2	3	0	0	6	7	8	6	7
33	1	0	0	4	5	6	7	8	4	5
34	0	2	3	4	0	6	7	8	6	8
35	1	2	0	0	5	6	7	8	6	7
36	1	0	3	4	5	0	7	8	7	8
37	1	2	3	0	5	6	7	0	6	7
38	1	0	3	4	5	6	0	8	4	5
39	0	2	0	4	5	6	7	8	4	7
40	1	2	3	4	0	0	7	8	7	8
41	1	2	0	4	5	6	7	0	6	7
42	1	0	3	4	5	6	0	8	4	6
43	0	2	3	4	5	0	7	8	5	7
44	1	0	3	4	5	6	0	8	4	5
45	1	2	3	0	5	0	7	8	5	8
46	1	2	0	4	5	6	7	0	5	6
47	1	2	3	4	0	6	0	8	4	6
48	0	2	3	0	5	6	7	8	5	6
49	1	2	0	4	0	6	7	8	6	7
50	1	0	3	4	5	6	0	8	4	8
51	1	2	3	0	5	0	7	8	5	8
52	1	2	3	4	0	6	7	0	4	6
53	1	2	0	4	5	6	0	8	4	6
54	1	0	3	4	5	0	7	8	7	8
55	1	2	3	0	5	6	7	0	6	7
56	1	0	3	4	5	0	7	8	4	7
57	1	2	3	0	0	6	7	8	6	8
58	1	0	3	4	5	6	0	8	5	8

OPR.	SECTIONS TO OBSERVE								DROPOUT SEC.	
59	0	2	3	0	5	6	7	8	6	8
60	1	2	3	4	0	6	7	0	4	7
61	1	0	3	0	5	6	7	8	6	7
62	1	2	3	4	0	6	0	8	4	8
63	1	2	3	0	5	6	7	0	5	7
64	1	2	3	4	0	6	0	8	4	8
65	1	0	3	4	5	0	7	8	4	5
66	1	2	0	4	5	6	7	0	5	7
67	1	2	3	4	0	6	0	8	4	6
68	0	2	0	4	5	6	7	8	4	5
69	1	2	3	4	0	0	7	8	4	7
70	0	2	0	4	5	6	7	8	5	7
71	1	2	3	0	0	6	7	8	6	7
72	0	2	3	4	5	0	7	8	7	8
73	1	2	3	0	5	6	0	8	5	6
74	1	2	0	4	5	6	7	0	5	7
75	1	2	3	0	5	6	0	8	5	8
76	0	2	3	4	5	0	7	8	5	8
77	1	2	0	4	0	6	7	8	6	7
78	0	2	3	0	5	6	7	8	6	8
79	1	0	3	4	5	6	0	8	4	8
80	0	2	3	0	5	6	7	8	7	8
81	1	2	0	4	5	6	7	0	5	6
82	1	0	3	0	5	6	7	8	5	6
83	0	2	3	4	5	0	7	8	4	5
84	1	2	3	4	0	6	0	8	4	6
85	1	2	0	4	5	0	7	8	5	8
86	1	2	3	4	0	6	0	8	6	8
87	0	2	0	4	5	6	7	8	4	6
88	1	2	3	4	0	6	7	0	6	7
89	0	2	0	4	5	6	7	8	5	6
90	1	0	3	0	5	6	7	8	7	8
91	1	2	0	4	5	6	0	8	4	6
92	1	2	3	4	0	6	7	0	4	7
93	1	2	3	0	5	6	0	8	5	6
94	0	2	3	4	0	6	7	8	4	7
95	1	2	0	0	5	6	7	8	7	8
96	1	2	3	4	0	6	7	0	6	7
97	1	0	3	4	5	0	7	8	7	8
98	0	2	3	4	0	6	7	8	4	6
99	1	2	0	4	5	6	0	8	4	5
100	0	2	3	4	5	0	7	8	4	5
101	1	0	3	4	5	6	0	8	5	6
102	0	2	3	0	5	6	7	8	7	8
103	1	2	0	4	0	6	7	8	4	7
104	1	2	3	0	5	6	7	0	5	6
105	0	2	3	4	0	6	7	8	4	7
106	1	0	3	4	5	0	7	8	7	8
107	1	2	3	0	5	6	7	0	5	6
108	1	2	0	4	5	6	0	8	6	8
109	0	2	3	4	0	6	7	8	6	8
110	1	2	3	0	5	6	7	0	6	7
111	1	0	3	4	0	6	7	8	4	6
112	0	2	0	4	5	6	7	8	5	6
113	1	2	3	4	0	6	7	0	6	7
114	0	2	3	0	5	6	7	8	5	7
115	1	0	3	4	5	6	0	8	4	6
116	1	2	0	4	5	0	7	8	4	8
117	1	2	3	0	0	6	7	8	6	7
118	1	2	0	4	5	6	0	8	4	6
119	1	2	3	4	0	6	7	0	4	7
120	1	0	0	4	5	6	7	8	5	6

Sampling Table
Operations with 9 sections

OPR.	SECTIONS TO OBSERVE									DROPOUT SEC.	
1	0	2	3	4	5	0	7	8	0	4	7
2	1	0	3	4	5	6	0	0	9	6	9
3	1	2	0	4	5	0	7	8	0	5	7
4	0	0	3	0	5	6	7	8	9	6	9
5	1	2	0	4	0	6	7	8	0	7	8
6	0	0	3	4	5	0	7	8	9	4	8
7	1	2	0	4	5	6	7	0	0	4	7
8	1	2	3	0	5	0	0	8	9	8	9
9	0	2	3	4	0	6	7	8	0	6	7
10	1	2	3	0	5	0	7	0	9	5	9
11	1	0	3	4	0	6	7	8	0	4	7
12	0	2	0	0	5	6	7	8	9	5	9
13	1	2	3	4	0	0	7	0	9	4	9
14	0	2	0	0	5	6	7	8	9	7	9
15	1	0	3	4	5	6	0	0	9	6	9
16	1	2	3	0	5	0	7	8	0	5	7
17	1	0	0	4	0	6	7	8	9	4	6
18	1	2	3	0	5	0	7	0	9	7	9
19	1	0	0	4	0	6	7	8	9	7	8
20	0	2	3	0	5	6	7	0	9	5	9
21	1	2	0	4	5	6	0	8	0	4	8
22	0	0	3	4	0	6	7	8	9	4	6
23	1	2	3	0	5	0	7	0	9	5	9
24	0	0	3	4	0	6	7	8	9	7	8
25	1	2	0	4	5	0	0	8	9	8	9
26	1	0	3	4	0	6	7	8	0	4	6
27	0	2	0	4	5	6	7	0	9	4	7
28	1	2	3	4	0	0	7	8	0	4	7
29	1	0	3	0	5	6	7	0	9	7	9
30	1	2	0	4	0	0	7	8	9	7	8
31	0	2	3	0	5	6	0	8	9	5	9
32	1	0	3	4	0	6	7	8	0	7	8
33	1	2	0	4	5	0	0	8	9	5	8
34	0	2	3	0	0	6	7	8	9	6	8
35	1	0	3	4	5	0	0	8	9	4	5
36	1	2	0	0	0	6	7	8	9	7	8
37	0	0	3	4	5	0	7	8	9	7	9
38	1	2	3	4	0	6	0	8	0	4	6
39	0	2	0	0	5	6	7	8	9	6	7
40	1	0	3	4	0	6	0	8	9	4	6
41	0	2	3	0	5	0	7	8	9	7	8
42	1	2	3	4	0	6	0	0	9	4	6
43	1	2	0	0	5	6	7	8	0	5	7
44	1	2	3	4	0	0	7	0	9	4	7
45	0	0	3	4	5	6	0	8	9	5	8
46	1	2	3	0	5	6	7	0	0	6	7
47	0	2	3	4	5	0	0	8	9	8	9
48	1	2	3	0	0	6	7	8	0	6	7
49	1	0	3	4	5	6	0	0	9	4	5
50	0	2	3	4	0	6	7	8	0	6	7
51	1	2	0	0	5	6	7	0	9	6	9
52	0	2	3	4	0	0	7	8	9	7	8
53	1	2	0	0	5	6	7	0	9	6	7
54	1	2	3	4	0	0	0	8	9	8	9
55	0	2	3	0	5	6	7	8	0	6	7
56	1	0	3	4	5	0	7	0	9	5	7
57	0	2	3	4	0	6	0	8	9	4	8
58	1	0	0	4	5	6	7	0	9	4	6

OPR.	SECTIONS TO OBSERVE									DROPOUT SEC.	
59	1	2	3	4	0	0	0	8	9	4	9
60	1	0	3	0	5	6	7	8	0	5	6
61	0	2	3	4	5	0	7	0	9	5	7
62	1	2	0	4	0	6	0	8	9	4	9
63	1	0	3	4	5	0	7	0	9	5	7
64	0	2	0	0	5	6	7	8	9	7	9
65	1	2	3	4	0	0	7	8	0	4	7
66	1	0	0	4	5	6	7	0	9	5	6
67	0	2	3	0	0	6	7	8	9	6	8
68	1	2	0	4	5	0	7	0	9	4	7
69	1	0	3	4	0	6	7	8	0	6	7
70	0	2	3	4	5	0	0	8	9	4	9
71	1	2	0	4	5	6	7	0	0	4	6
72	0	2	3	4	0	6	0	8	9	6	9
73	1	2	0	4	5	0	7	0	9	4	7
74	0	2	3	4	0	6	0	8	9	6	9
75	1	2	3	0	5	0	7	0	9	5	7
76	1	2	3	4	0	6	0	8	0	4	8
77	1	2	0	4	5	0	7	0	9	4	9
78	0	2	3	0	0	6	7	8	9	6	8
79	1	2	0	4	5	6	7	0	0	6	7
80	0	0	3	0	5	6	7	8	9	6	7
81	1	2	0	4	0	0	7	8	9	8	9
82	1	2	3	0	5	6	0	8	0	6	8
83	0	2	3	4	5	0	7	0	9	7	9
84	1	2	0	4	0	6	0	8	9	6	9
85	0	2	3	0	5	6	7	0	9	6	9
86	1	2	0	4	5	0	0	8	9	4	5
87	0	2	3	4	0	6	7	8	0	4	6
88	1	0	0	4	5	6	7	0	9	4	5
89	1	2	3	0	5	6	0	8	0	5	6
90	0	2	3	4	0	6	7	0	9	4	7
91	1	2	0	4	5	6	0	8	0	4	8
92	1	2	3	0	0	6	7	0	9	6	9
93	0	0	3	4	5	6	0	8	9	5	9
94	1	2	0	4	0	0	7	8	9	4	9
95	0	0	3	0	5	6	7	8	9	8	9
96	1	2	0	4	5	0	7	0	9	4	9
97	1	0	3	4	5	6	0	8	0	4	6
98	1	2	3	0	0	6	7	0	9	7	9
99	0	2	3	4	5	0	0	8	9	5	8
100	1	0	0	4	0	6	7	8	9	4	7
101	1	2	3	0	5	0	7	8	0	7	8
102	1	0	0	4	5	6	7	0	9	5	6
103	1	2	3	0	0	6	7	8	0	6	8
104	1	2	0	4	5	0	0	8	9	8	9
105	1	0	3	4	0	6	7	0	9	4	6
106	1	2	0	0	5	6	7	8	0	6	8
107	0	2	3	4	0	0	7	8	9	8	9
108	1	2	3	0	5	6	0	0	9	5	9
109	0	2	3	4	0	0	7	8	9	8	9
110	1	0	3	0	5	6	0	8	9	5	8
111	1	2	0	4	0	0	7	8	9	7	8
112	1	0	3	4	5	6	0	0	9	6	9
113	1	2	0	4	5	0	7	8	0	5	8
114	1	2	3	0	5	6	0	0	9	5	6
115	1	2	0	4	0	0	7	8	9	4	8
116	0	2	3	0	5	6	0	8	9	6	8
117	1	0	0	4	5	0	7	8	9	4	8
118	0	2	3	0	5	6	7	0	9	5	6
119	1	0	0	4	5	6	0	8	9	4	9
120	1	2	3	0	0	6	7	0	9	6	7

Sampling Table
Operations with 10 sections

OPR.	SECTIONS TO OBSERVE										DROPOUT SEC.	
1	1	2	0	4	0	6	7	8	9	0	4	7
2	1	2	3	0	5	6	7	0	0	10	6	10
3	0	2	3	4	5	0	7	8	9	0	4	7
4	1	2	0	0	0	6	7	8	9	10	7	10
5	1	0	3	4	5	6	0	8	0	10	6	10
6	0	2	0	4	5	6	7	0	9	10	4	9
7	1	0	3	4	0	6	7	8	9	0	8	9
8	1	2	0	4	5	0	0	8	9	10	8	10
9	0	2	3	4	0	6	7	8	0	10	6	10
10	1	0	3	4	5	0	0	8	9	10	8	9
11	1	2	3	0	0	6	7	8	9	0	6	8
12	1	0	3	4	5	0	7	0	9	10	4	5
13	1	2	3	4	0	6	0	8	0	10	6	8
14	1	2	0	0	5	6	7	0	9	10	7	9
15	1	0	3	4	0	6	7	8	9	0	6	9
16	1	2	3	0	5	0	0	8	9	10	5	8
17	0	2	3	4	0	6	7	8	0	10	4	8
18	1	0	0	4	5	0	7	8	9	10	8	9
19	1	2	3	0	0	6	7	8	9	0	8	9
20	1	0	3	4	5	0	7	8	0	10	5	10
21	1	2	3	0	0	6	7	8	9	0	7	8
22	1	0	3	4	5	0	7	8	0	10	4	10
23	1	2	3	4	0	6	7	0	9	0	4	7
24	0	0	3	4	5	6	0	8	9	10	8	9
25	1	2	3	4	0	0	7	0	9	10	7	10
26	1	2	3	0	5	6	7	8	0	0	5	8
27	1	0	3	4	5	0	0	8	9	10	5	9
28	0	2	3	4	0	6	7	8	0	10	4	10
29	1	0	0	4	5	0	7	8	9	10	9	10
30	1	2	3	0	0	6	7	0	9	10	9	10
31	0	0	3	4	5	0	7	8	9	10	8	9
32	1	2	3	0	5	6	7	8	0	0	7	8
33	1	0	0	4	5	6	0	8	9	10	5	10
34	0	2	3	4	5	0	7	8	9	0	5	9
35	1	0	3	0	5	6	0	8	9	10	8	10
36	1	2	3	4	0	6	7	0	0	10	6	7
37	1	2	3	0	5	0	7	8	9	0	5	8
38	0	2	3	4	0	6	0	8	9	10	4	10
39	1	2	0	4	5	6	7	0	9	0	6	7
40	0	2	3	0	0	6	7	8	9	10	6	8
41	1	2	0	4	5	6	7	0	0	10	5	7
42	0	0	3	4	0	6	7	8	9	10	6	8
43	1	2	3	0	5	0	7	8	0	10	5	7
44	0	0	3	4	5	6	0	8	9	10	9	10
45	1	2	3	0	0	0	7	8	9	10	7	9
46	0	2	0	4	5	6	7	0	9	10	6	9
47	1	0	3	4	0	6	7	8	0	10	7	8
48	1	2	0	0	5	6	7	0	9	10	7	9
49	1	0	3	4	0	6	7	8	0	10	6	7
50	1	2	3	0	5	6	7	0	9	0	6	9
51	0	2	0	4	5	6	0	8	9	10	9	10
52	1	0	3	4	0	6	7	0	9	10	4	10
53	1	2	0	4	5	6	0	8	9	0	4	6
54	1	0	3	0	5	6	7	0	9	10	5	6
55	0	2	0	4	5	6	0	8	9	10	6	9
56	1	2	3	0	5	6	7	0	0	10	5	10
57	0	0	3	4	5	0	7	8	9	10	7	10
58	1	2	3	4	0	6	0	8	9	0	4	9

OPR.	SECTIONS TO OBSERVE										DROPOUT SEC.	
59	1	2	3	0	5	6	7	0	0	10	6	10
60	0	2	0	4	5	0	7	8	9	10	5	8
61	1	2	3	0	5	6	0	8	9	0	6	8
62	1	0	3	4	0	6	7	8	0	10	4	6
63	0	2	3	4	5	0	7	8	9	0	7	8
64	1	2	3	4	0	6	0	0	9	10	4	6
65	1	2	0	4	5	0	7	8	0	10	4	10
66	0	2	3	4	0	6	7	8	9	0	8	9
67	1	0	3	0	5	6	7	0	9	10	7	10
68	1	2	3	4	0	6	0	8	0	10	4	8
69	1	0	3	0	5	6	7	0	9	10	5	7
70	1	2	3	4	0	0	0	8	9	10	4	10
71	1	2	0	4	5	6	7	0	9	0	5	6
72	0	2	3	4	0	0	7	8	9	10	8	9
73	1	0	3	4	5	6	0	8	0	10	4	10
74	0	2	3	4	5	0	7	0	9	10	5	7
75	1	2	0	4	5	6	0	8	9	0	5	6
76	0	2	3	4	0	6	7	0	9	10	4	9
77	1	0	0	4	5	6	0	8	9	10	5	6
78	1	2	3	0	5	6	7	0	9	0	5	7
79	0	2	3	4	0	6	7	8	0	10	6	10
80	1	0	3	4	5	6	0	0	9	10	4	9
81	1	2	0	0	5	0	7	8	9	10	8	9
82	0	0	3	4	0	6	7	8	9	10	4	10
83	1	2	3	0	5	0	7	8	0	10	7	10
84	0	0	3	4	0	6	7	8	9	10	4	6
85	1	2	0	0	5	0	7	8	9	10	8	9
86	0	0	3	4	0	6	7	8	9	10	6	7
87	1	2	0	4	5	6	7	0	9	0	6	9
88	0	2	3	4	5	0	7	8	0	10	5	8
89	1	2	0	0	5	6	7	0	9	10	6	9
90	1	0	3	4	5	0	7	8	0	10	5	10
91	0	2	3	4	0	6	7	8	9	0	4	8
92	1	2	3	0	5	0	7	8	0	10	5	8
93	1	2	0	4	0	6	7	8	9	0	7	8
94	0	2	3	0	5	6	7	0	9	10	6	9
95	1	0	3	4	0	6	0	8	9	10	8	10
96	1	2	0	4	5	0	7	8	9	0	4	9
97	0	2	3	4	0	6	7	8	0	10	4	7
98	1	2	3	0	5	6	0	0	9	10	5	10
99	1	2	3	4	0	6	7	8	0	0	4	7
100	1	2	3	0	5	6	0	0	9	10	5	9
101	1	2	3	4	0	0	7	8	0	10	4	10
102	1	0	3	0	5	6	0	8	9	10	6	8
103	1	2	3	4	0	0	7	8	0	10	7	10
104	1	0	3	4	5	6	0	0	9	10	9	10
105	1	2	3	4	0	6	7	8	0	0	6	8
106	1	0	3	0	5	0	7	8	9	10	5	10
107	0	2	0	4	5	6	0	8	9	10	4	6
108	1	2	3	0	5	6	7	8	0	0	6	7
109	0	2	3	4	5	0	0	8	9	10	5	9
110	1	2	0	0	5	6	7	8	0	10	6	7
111	0	2	3	4	0	6	0	8	9	10	6	9
112	1	2	0	4	5	6	7	0	9	0	6	9
113	0	0	3	4	5	0	7	8	9	10	4	9
114	1	2	0	4	5	6	0	8	9	0	4	5
115	0	2	3	0	5	6	7	0	9	10	5	9
116	1	2	0	4	5	0	0	8	9	10	5	10
117	1	0	3	4	0	6	7	8	0	10	4	10
118	0	2	3	0	5	6	0	8	9	10	6	9
119	1	2	3	4	0	0	7	8	9	0	4	7
120	1	0	0	4	5	6	0	8	9	10	4	9

Sampling Table
Operations with 11 sections

OPR.	SECTIONS TO OBSERVE											DROPOUT SEC.	
1	1	2	0	4	5	0	7	8	0	10	0	8	10
2	1	0	3	4	0	6	0	8	9	0	11	8	11
3	0	2	3	0	5	0	7	8	9	10	0	5	8
4	1	2	3	4	0	6	0	8	0	0	11	8	11
5	1	0	3	4	5	0	7	0	9	10	0	4	7
6	0	2	3	0	0	6	7	8	0	10	11	6	10
7	1	0	0	4	5	6	7	0	9	0	11	5	6
8	0	2	3	4	0	6	0	8	9	10	0	6	9
9	1	0	3	0	5	0	7	8	9	0	11	5	7
10	1	2	0	4	5	6	0	0	9	10	0	5	6
11	0	0	3	4	0	6	7	8	0	10	11	7	10
12	1	2	0	0	5	0	7	8	9	10	0	5	7
13	1	2	3	4	0	6	0	0	0	10	11	4	11
14	1	0	0	0	5	0	7	8	9	10	11	8	9
15	1	2	3	4	0	6	7	0	9	0	0	4	7
16	1	0	3	0	5	0	7	8	0	10	11	7	11
17	0	2	0	4	5	6	0	0	9	10	11	4	6
18	1	0	3	4	5	0	7	8	0	10	0	4	10
19	1	2	3	0	5	6	0	0	9	0	11	5	6
20	0	2	3	4	0	0	7	8	9	10	0	7	8
21	1	0	0	0	5	6	7	0	9	10	11	5	7
22	0	2	3	4	0	0	7	8	9	10	0	4	10
23	1	2	3	0	5	6	0	0	0	10	11	5	10
24	1	0	3	4	5	0	7	8	9	0	0	4	7
25	0	2	0	4	0	6	0	8	9	10	11	4	6
26	1	0	3	4	5	0	7	0	0	10	11	4	7
27	1	2	3	0	0	6	0	8	9	10	0	8	9
28	0	2	0	4	5	0	7	0	9	10	11	4	7
29	1	2	3	0	5	6	7	8	0	0	0	7	8
30	0	2	0	4	5	0	7	0	9	10	11	7	9
31	1	0	3	0	5	6	7	8	0	10	0	6	10
32	0	2	0	4	0	6	7	0	9	10	11	10	11
33	1	0	3	4	5	0	0	8	9	0	11	4	8
34	0	2	0	4	0	6	7	8	9	10	0	4	10
35	1	0	3	0	5	6	7	8	0	0	11	7	8
36	0	2	0	4	0	6	0	8	9	10	11	10	11
37	1	2	3	0	5	0	7	0	9	0	11	5	9
38	0	2	0	4	0	6	7	8	0	10	11	4	8
39	1	0	3	4	5	0	7	0	9	10	0	9	10
40	1	2	0	0	5	6	0	8	9	0	11	9	11
41	0	0	3	4	0	0	7	8	9	10	11	10	11
42	1	2	0	0	5	6	0	8	9	0	11	6	11
43	1	2	3	4	0	0	7	8	0	10	0	8	10
44	0	0	0	4	5	6	7	0	9	10	11	5	10
45	1	2	3	4	0	6	0	8	0	10	0	8	10
46	1	2	0	0	5	6	7	0	9	0	11	5	11
47	0	0	3	4	0	0	7	8	9	10	11	9	10
48	1	2	3	0	5	6	7	0	9	0	0	5	9
49	0	0	3	4	0	6	7	8	0	10	11	4	11
50	1	2	0	0	5	6	7	0	9	10	0	9	10
51	0	2	3	4	5	0	0	8	0	10	11	4	10
52	1	0	3	4	0	6	7	0	9	0	11	6	7
53	1	2	0	0	5	0	7	8	9	10	0	5	8
54	0	0	3	4	0	6	0	8	9	10	11	4	9
55	1	2	3	0	5	0	7	0	9	0	11	5	7
56	1	0	0	4	0	6	7	8	9	10	0	7	10
57	1	2	3	0	5	6	0	0	9	0	11	9	11
58	0	2	3	4	0	0	7	8	0	10	11	7	10

OPR.	SECTIONS TO OBSERVE											DROPOUT SEC.	
59	1	2	0	4	5	6	0	0	9	10	0	4	5
60	1	0	3	0	5	6	7	8	0	0	11	7	8
61	0	2	3	4	0	0	7	0	9	10	11	4	9
62	1	0	0	4	5	6	0	8	9	10	0	6	10
63	0	2	3	4	0	0	7	8	0	10	11	4	11
64	1	0	0	4	5	6	0	8	9	10	0	5	8
65	1	2	3	0	0	6	7	8	0	0	11	7	11
66	0	2	3	4	5	0	0	8	9	10	0	5	8
67	1	2	0	0	0	6	7	0	9	10	11	6	11
68	0	2	3	4	5	0	7	8	9	0	0	4	9
69	1	2	3	4	0	6	0	0	0	10	11	4	6
70	0	2	0	4	5	0	7	8	9	0	11	4	11
71	1	0	3	4	0	6	0	8	9	10	0	4	6
72	1	2	0	4	5	6	7	0	0	0	11	6	7
73	1	2	3	0	0	6	0	8	9	10	0	6	10
74	0	2	3	4	5	0	7	0	9	0	11	4	5
75	1	2	3	4	0	6	0	8	0	10	0	4	8
76	1	0	0	4	5	0	7	8	9	0	11	5	9
77	0	2	3	0	5	6	7	8	0	10	0	5	10
78	1	0	3	4	0	0	7	8	9	0	11	7	9
79	1	2	0	4	5	6	0	0	9	10	0	5	9
80	1	2	3	0	0	6	7	8	0	0	11	8	11
81	1	0	3	4	5	0	0	0	9	10	11	9	10
82	0	2	3	0	0	6	7	8	9	10	0	6	8
83	1	2	0	4	5	6	0	0	0	10	11	10	11
84	1	0	3	4	0	0	7	8	9	0	11	7	9
85	0	2	0	4	5	6	0	8	0	10	11	6	8
86	1	2	3	0	0	6	7	0	9	0	11	6	9
87	1	0	3	4	5	6	0	8	0	10	0	4	10
88	0	2	0	4	5	0	7	8	9	0	11	7	8
89	1	0	3	0	0	6	0	8	9	10	11	6	11
90	1	2	0	4	5	0	7	8	0	10	0	5	10
91	0	0	3	4	0	6	7	0	9	10	11	9	10
92	1	2	0	4	5	6	0	8	9	0	0	4	6
93	1	0	3	4	5	0	7	0	0	10	11	7	10
94	0	2	0	4	5	6	0	8	9	10	0	5	6
95	1	2	3	4	0	6	7	0	0	0	11	7	11
96	1	0	0	4	5	0	7	8	9	10	0	4	5
97	0	2	3	0	5	6	7	0	0	10	11	6	10
98	1	0	0	4	5	6	0	8	9	0	11	4	9
99	0	2	3	4	0	6	7	0	0	10	11	6	10
100	1	2	0	4	5	0	7	8	9	0	0	4	7
101	0	2	3	0	5	6	7	0	0	10	11	5	11
102	1	2	0	4	5	0	7	8	9	0	0	5	8
103	1	0	3	0	5	6	0	8	0	10	11	6	8
104	0	2	3	4	5	0	7	0	9	0	11	5	9
105	1	2	0	0	0	6	7	8	0	10	11	6	10
106	1	0	3	4	5	0	7	0	9	10	0	9	10
107	1	2	0	0	0	6	7	8	9	0	11	6	11
108	0	2	3	4	5	0	0	8	9	10	0	4	8
109	1	2	3	0	0	6	7	0	9	0	11	9	11
110	1	0	3	4	5	0	7	8	0	10	0	4	5
111	0	2	0	4	0	6	0	8	9	10	11	8	11
112	1	0	3	0	5	0	7	8	9	0	11	7	8
113	0	2	3	4	0	6	7	0	9	10	0	6	7
114	1	2	0	0	5	6	0	8	9	0	11	5	6
115	1	2	3	4	0	0	7	8	0	10	0	7	8
116	1	2	0	4	5	6	0	0	9	0	11	5	6
117	1	2	3	0	5	0	7	8	0	10	0	5	10
118	1	0	0	4	0	6	7	8	9	0	11	7	9
119	1	2	3	0	5	6	7	0	0	10	0	5	6
120	1	0	0	4	5	6	0	8	9	0	11	4	11

Sampling Table
Operations with 12 sections

OPR.	SECTIONS TO OBSERVE												DROPOUT SEC.	
1	1	2	0	4	0	0	0	0	9	10	11	12	9	10
2	0	0	3	0	5	6	7	8	0	0	11	12	6	11
3	1	2	0	4	5	0	0	0	9	10	0	12	9	12
4	1	2	3	0	0	6	7	8	0	0	11	0	7	11
5	0	0	3	4	5	0	7	0	9	10	0	12	5	7
6	1	2	0	4	5	6	0	8	0	0	11	0	8	11
7	1	0	3	0	0	0	7	8	9	10	0	12	7	12
8	1	2	0	4	5	6	0	8	0	0	11	0	4	8
9	0	2	3	4	0	0	7	0	9	10	0	12	4	12
10	1	0	0	0	5	6	0	8	0	10	11	12	5	11
11	0	2	3	4	0	6	7	0	9	0	11	0	9	11
12	1	2	3	0	5	0	0	8	0	10	0	12	5	10
13	0	0	0	4	5	6	7	0	9	0	11	12	4	11
14	1	2	3	4	0	0	0	8	0	10	11	0	4	8
15	0	2	0	0	5	6	7	0	9	10	0	12	7	12
16	1	0	3	4	0	6	0	8	9	0	11	0	8	9
17	0	2	0	0	5	6	7	0	0	10	11	12	11	12
18	1	0	3	4	0	6	0	8	9	10	0	0	6	10
19	0	2	0	0	5	0	7	8	9	0	11	12	8	9
20	1	2	3	4	0	6	0	0	0	10	0	12	6	10
21	1	0	0	0	5	0	7	8	9	10	11	0	7	8
22	0	2	3	4	0	6	0	8	9	0	0	12	4	9
23	1	0	3	4	5	0	7	0	0	10	11	0	4	10
24	0	2	3	0	0	6	0	8	9	10	0	12	8	9
25	1	0	0	4	5	6	7	0	0	0	11	12	5	7
26	1	2	3	0	5	0	0	8	9	10	0	0	5	10
27	1	0	0	4	0	6	7	0	9	0	11	12	7	12
28	0	2	3	0	5	0	0	8	9	10	11	0	5	9
29	1	2	0	4	0	6	7	0	9	0	0	12	4	12
30	0	2	3	0	5	6	0	8	0	10	11	0	6	11
31	1	0	0	4	5	0	7	8	9	0	0	12	8	12
32	1	2	3	0	0	6	0	0	9	10	11	0	6	10
33	0	2	3	4	5	0	7	8	0	0	0	12	4	8
34	1	0	0	4	5	6	0	0	9	10	11	0	5	9
35	0	2	3	0	5	0	7	8	9	0	0	12	5	7
36	1	0	0	4	0	6	0	8	0	10	11	12	6	12
37	0	2	3	4	5	0	7	0	9	10	0	0	7	10
38	1	0	0	0	0	6	7	8	0	10	11	12	6	11
39	0	2	3	4	5	0	0	0	9	10	11	0	5	10
40	1	0	0	4	0	6	7	8	0	0	11	12	7	11
41	0	2	3	4	5	0	0	0	9	10	0	12	5	10
42	1	0	0	0	5	6	7	8	0	0	11	12	11	12
43	0	2	3	4	0	0	0	8	9	10	11	0	9	10
44	1	0	0	4	5	6	7	0	0	0	11	12	6	11
45	0	2	3	0	0	0	7	8	9	10	11	0	7	11
46	1	2	0	4	5	6	0	8	0	0	0	12	8	12
47	0	2	3	0	0	6	7	0	9	10	11	0	6	11
48	1	2	0	4	5	0	7	8	0	0	0	12	7	8
49	0	0	3	0	5	6	0	8	9	10	11	0	8	11
50	1	2	0	4	5	6	7	0	0	0	0	12	6	12
51	0	2	3	0	5	0	0	8	9	10	11	0	5	11
52	1	2	3	4	0	6	7	0	0	0	0	12	7	12
53	0	2	0	4	5	0	0	8	9	10	11	0	4	11
54	1	0	3	0	0	6	7	0	9	10	0	12	6	7
55	1	2	0	4	5	0	0	8	0	10	11	0	4	10
56	0	0	3	4	0	6	7	0	9	10	0	12	4	6
57	1	2	0	4	5	0	0	8	0	10	11	0	5	8
58	1	0	3	0	5	6	7	0	9	0	0	12	5	6

OPR.	SECTIONS TO OBSERVE												DROPOUT SEC.	
59	1	2	0	4	0	0	7	8	0	10	11	0	8	11
60	1	0	3	0	5	6	7	0	9	0	0	12	6	7
61	0	2	0	4	5	0	0	8	9	10	11	0	5	10
62	1	0	3	0	0	6	7	0	9	10	0	12	6	10
63	0	2	0	4	5	0	7	8	9	0	11	0	4	11
64	1	0	3	0	0	6	0	8	9	10	0	12	6	12
65	0	2	0	4	5	6	7	0	0	0	11	12	4	11
66	1	2	3	0	0	0	7	8	9	10	0	0	8	9
67	0	0	0	4	5	6	0	8	0	10	11	12	6	10
68	1	2	3	0	5	6	7	0	9	0	0	0	6	9
69	1	0	0	4	0	0	7	8	0	10	11	12	4	12
70	0	2	3	0	5	6	0	8	9	10	0	0	8	9
71	1	0	0	4	0	6	7	8	0	0	11	12	6	11
72	0	2	3	0	5	6	0	0	9	10	0	12	6	10
73	1	0	0	4	0	0	7	8	9	10	11	0	9	11
74	0	2	3	0	5	6	0	0	9	10	0	12	9	10
75	1	0	0	4	0	6	7	8	0	10	11	0	10	11
76	1	2	3	0	5	0	0	8	9	0	0	12	5	12
77	1	2	0	4	0	6	7	0	0	10	11	0	4	11
78	0	2	3	0	5	0	7	8	9	0	0	12	5	12
79	1	0	3	4	0	6	7	0	0	10	11	0	4	10
80	0	2	3	4	5	0	0	8	9	0	0	12	5	9
81	1	0	0	4	5	6	7	0	0	10	11	0	4	6
82	0	2	3	0	0	0	7	8	9	0	11	12	8	11
83	1	0	0	4	5	6	0	8	0	10	11	0	4	10
84	1	2	3	0	0	0	7	8	9	0	0	12	9	12
85	0	0	3	4	5	6	0	0	0	10	11	12	11	12
86	1	2	0	0	0	0	7	8	9	10	11	0	7	11
87	1	0	3	4	5	6	0	0	0	0	11	12	4	12
88	0	2	0	0	0	6	7	8	9	10	0	12	8	12
89	1	0	3	4	5	6	0	0	0	10	11	0	4	10
90	1	2	0	4	0	0	7	8	9	0	0	12	4	12
91	1	0	3	0	5	6	0	0	0	10	11	12	11	12
92	0	2	0	4	0	6	7	8	9	10	0	0	7	10
93	1	0	3	4	5	0	0	0	9	0	11	12	11	12
94	1	2	0	0	5	6	7	8	0	10	0	0	6	7
95	0	0	3	4	0	0	7	0	9	10	11	12	10	11
96	1	2	3	0	5	6	7	8	0	0	0	0	5	8
97	1	0	0	4	0	0	0	8	9	10	11	12	10	11
98	0	2	3	0	5	6	7	0	9	0	11	0	5	11
99	1	0	0	4	5	6	0	8	0	10	0	12	10	12
100	0	2	3	4	0	0	7	0	9	0	11	12	4	9
101	1	2	0	4	5	6	0	8	0	10	0	0	5	10
102	1	0	3	0	5	0	7	0	9	0	11	12	7	9
103	0	2	0	4	0	6	7	8	0	10	11	0	4	10
104	1	0	3	0	5	0	0	8	9	10	0	12	5	10
105	0	2	0	4	0	6	7	0	9	0	11	12	9	12
106	1	0	3	4	5	0	0	8	9	10	0	0	8	10
107	0	2	0	4	0	6	7	0	0	10	11	12	7	10
108	1	2	3	0	5	0	7	8	9	0	0	0	5	7
109	0	2	3	4	0	6	0	0	0	10	11	12	4	11
110	1	0	3	0	5	0	7	8	9	0	0	12	5	9
111	0	2	0	4	0	6	0	8	9	10	11	0	4	11
112	1	0	3	0	5	6	7	0	0	0	11	12	6	7
113	1	2	0	4	5	0	0	8	9	10	0	0	4	10
114	0	2	3	0	5	6	7	0	0	0	11	12	6	7
115	1	2	0	4	0	0	7	8	9	10	0	0	4	8
116	0	0	3	4	5	6	0	8	0	0	11	12	8	12
117	1	2	3	0	0	0	7	0	9	10	0	12	10	12
118	0	2	0	4	5	6	0	8	0	0	11	12	4	5
119	1	0	3	4	0	0	7	0	9	10	11	0	4	11
120	1	2	3	0	5	6	0	8	0	0	0	12	5	8

3.3 CORE BIOLOGICAL SAMPLING

3.3.1 Salmon Biological Sampling

Body Location to be Sampled for Scales

Scales should be taken as close as possible to the point on an imaginary line drawn from the posterior edge of the dorsal fin to the anterior edge of the anal fin, one or two scale rows above or below the lateral line. Do not take a scale from the lateral line, as its morphology is quite different from that of the "preferred" scales and lateral line scales are useless for determination of age or species. If scales must be taken from an area other than "A" or "B" as shown in Figure 3-1, please indicate the area sampled in the left margin of the data sheet on the line corresponding to that sample. Scales will be affixed to a gummed card and later using heat and pressure in a press a acetate impression of the scales will be produced for analysis.

Removal of Scales, Placement on Gummed Card

Up to 5 scales should be sampled from slightly different areas of each fish. Remove a single scale with the forceps, and do not release it from the forceps until it is attached to the gummed card. Remember which side is "exterior" and which is toward the fish. Gently clean each side of the scale to remove epidermal tissue, mucus, and debris, including all guanine (silver tissue). Cleaning can be done quickly by gently wiping each side of the scale along a damp cloth, or by gently rubbing the scale between clean damp fingers. Quickly examine the scale for obvious malformation or gross regeneration, and choose another if it appears deformed. Dampen the smooth side of the scale (i.e., the side toward the fish) and affix it to the gummed card by placing it over the number corresponding to the scale number and pressing down lightly. The scale should be dampened so as to liquify enough glue on the gummed card to ensure good adhesion. The entire surface of the scale should be adhered to the gummed card; loose edges often lead to loss of the scale during production of plastic impressions for final analyses. Too much moisture causes glue to flow onto the top side occluding the circuli and later producing a poor or useless plastic impression. Be sure to place each scale from the fish directly over the appropriate number.

Recording Biological Data; Storage of Scale Cards

The biological data forms provided were drafted specifically for salmonids. The following should be used to identify species:

Sockeye
Chum
Pink
Coho
Chinook
Steelhead
Unknown

Recording Salmonid Scale Data

Each vessel observed will be assigned its own series of scale cards using vessel license number and beginning with scale card number 001 and incrementing by one as additional scale cards are filled during sampling. Begin a new scale card for each operation. NOTE: the scale cards are numbered from right to left, on the gummed side of the scale card, so that the scale impressions will be numbered from left to right one they are produced.

On the Back of the Gummed Card

Refer to Figure 3-2:

1.) Enter the identifying information in the appropriate place: vessel name on the blank followed by the vessel license number, operation, section, and the scale card number in the spaces provided.

2.) Record species in the appropriate space on the card.

3.) Record the straight line length in millimeters from the tip of the snout to the fork in the tail (TSFT) in the appropriate space on the card.

4.) Record sex in the appropriate space on the card (M=male, F=female).

5.) Record gonad weight if you have a balance for weighing gonads.

6.) Leave age columns blank.

Make sure the scale cards are properly labeled and perfectly dry before stacking them for storage. Scale cards should be sandwiched between the acetate sheets provided, wrapped with rubber bands and kept in a plastic ziplock bag to keep them dry.

SCALE #	1-5	6-10	11-15	16-20	21-25	
SPECIES						
FORK LEN						
SEX						
G.W.						
AGE						
VESSEL_____ LIC._____ CARD_____						
OPERATION _____ SEC _____						

Sampling of Gonads from Salmonids

Gonad weight will be measured by those observers equipped with balances. Gonad weight is used to ascertain whether or not the fish would have reached maturity in the year of sampling; gonads of maturing salmonids will generally weigh more than about 10 grams during their last summer at sea. Only sockeye, chinook and chum salmon and steelhead trout need to be sampled for gonad weight since coho and pink salmon will nearly always mature after their second summer at sea.

The gonads are located at the anterior end of the body cavity and ventral to the swim bladder. In immature fish they appear as thin ribbons of tissue only a few inches in length. As the fish grows and matures the gonads elongate and the testes and ovaries become easily distinguishable. The ovaries will have a granular appearance in comparison to the testes which will appear smooth and lighter in color than the ovaries. The ovaries eventually take on a light orange color while the testes will appear translucent to white. To extract the gonads you should slit the abdomen from the anus along the ventral midline to beneath the gill covers and then cut dorsally along the side behind the pectoral fin (located posterior to the gill covers) to the backbone such that the side of the fish can be folded dorsally over the back. An additional dorsal cut near the anus and up to the backbone may be helpful in allowing the side of the fish to remain folded over and out of your view of the body cavity. The gonads lie below the swim bladder and are attached to the body wall at the extreme anterior end. Once the gonads are located, resect them from the body wall and remove them. Use the small silver balance to weigh the gonads and then record the weight in whole grams on the back of the gummed scale card in the position corresponding to where you recorded species, fork length in millimeters, and sex for this same fish.

Collecting Salmonid Snouts

Some agencies identify salmonids by inserting a coded-wire tag into the snout of fingerling salmonids. These wire-tagged salmonids are marked by clipping their adipose fins. If you find a salmonid missing an adipose fin, check to see whether it is missing any other fins, collect a scale sample, record the usual data, and in addition, weigh the gonads. Remove the snout by cutting well behind the eye (Figure 3-1), salt the snout liberally, attach the completed data tag to the snout, and seal it in one of the provided plastic bags. After a few days, drain off any accumulated liquid, rinse the snout and resalt it. Repeat the draining and resalting as needed. The sample snout should not stink. The tag should be filled out in pencil and the scale card number written on the tag. Snouts are to be returned to North America with the observer's baggage and turned in at the debriefing.

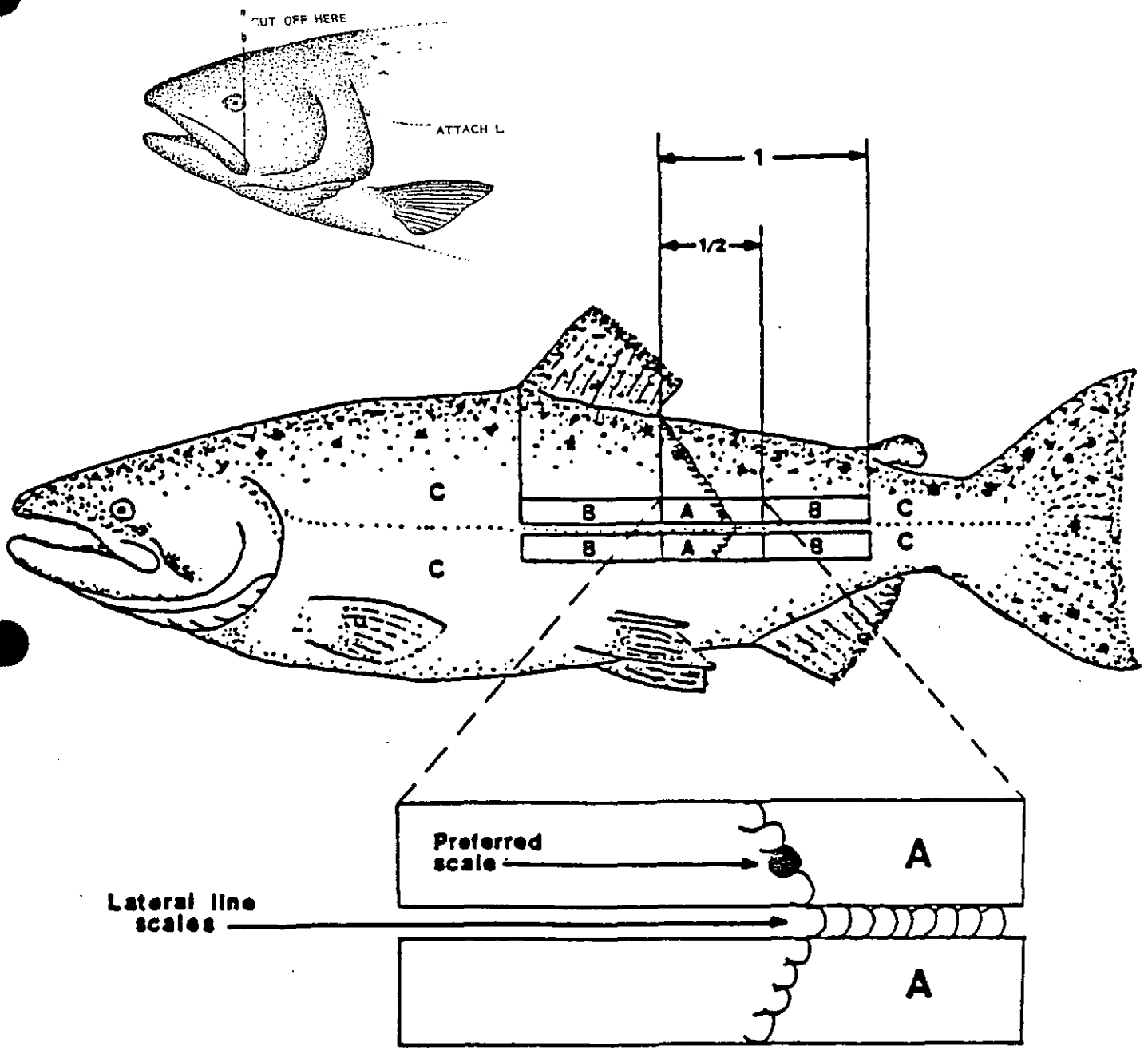
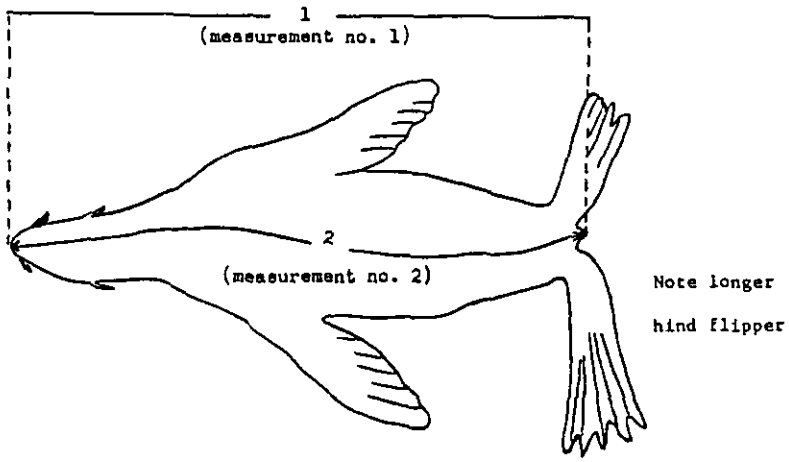


Figure 3-1 Area of the salmonid's body designated as "preferred" (Area A) by the International North Pacific Fisheries Commission. Note the location of the "preferred" scale. Whenever possible, scales should be taken from Area A.

3.3.2 Marine Mammal Length And Sex Data

All observers will take length and sex data on all dead marine mammals that come up in the net if time is available. All animals will be assigned a specimen number, and all data collected should be recorded on a Life History Form (see Figure 3-3).

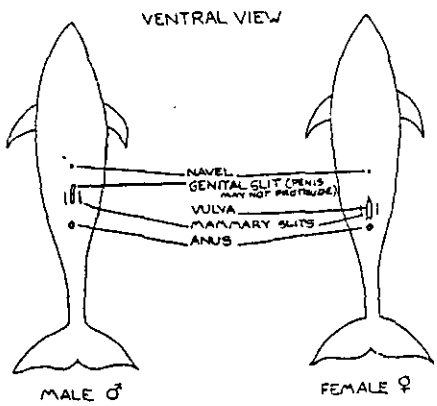


Upper half of diagram is of Steller Sea Lion, lower half is of Northern Fur Seal.

Standard Length (measurement no. 1) is the straight-line distance from snout to tip of tail flesh on the unskinned body, belly up, ideally with the head and vertebral column on a straight line. If rigor has set in, then this measurement probably cannot be taken and measurement no. 2 should be taken.

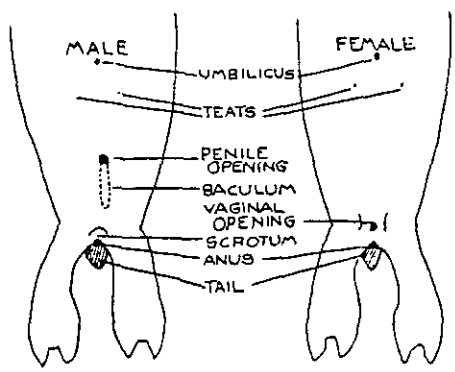
Curvilinear Length (measurement no. 2) is taken when the seal cannot be stretched belly up, as when rigor sets in, or is too heavy to be moved. It is the shortest surface distance from snout to tip of tail flesh along back, belly, or side. Record the type of measurement taken. Seals are usually measured with a flexible tape.

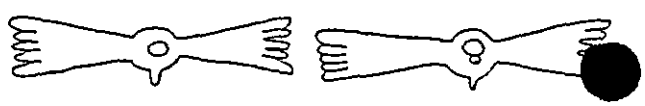
Some morphological differences between male and female cetaceans.



THE DISTANCE BETWEEN THE ANUS AND THE GENITALS IS GREATER IN MALES; OTHERWISE THE SEXES APPEAR SIMILAR BECAUSE MALES HAVE EXTERNAL TEATS, AND FEMALES HAVE ENLARGED CLITORI. IF POSSIBLE, TAKE A PHOTOGRAPH OR MAKE A DRAWING.

Some morphological differences between male and female pinnipeds.





PORPOISE LIFE HISTORY FORM– 1987

Observer aboard U.S.☐ JFA☐ None☐ Catcherboat name/no. IKA MARU #7

Card [1] (1) Cruise no. [ ] (2–5) Mothership specimen no. [ ] Specimen no. [J00 Ø12] (6–12)

Species/stock LISSODELPHIS BOREALIS [LB] (13–14) Sex [2] (1=Male 2=Female) (15)

Total length (cm) [0213] (16–19) Total weight (kg) [ ] (20–23)

Haul date (yr/mo/day) [900608] (24–29) Capture position (lat/long) [3133 1179 52] (30–38) Quadrant [2] (0=NW 2=NE) (39)

Specimens and measurements (1=yes 2=no 3=not applicable 4=with head, carcass)

NO DISSECTION

Carcass ☐ (40)	Mammary tissue ☐	Special Collections
Head ☐ (41)	Mammary depth (cm) [.]	☐
Teeth ☐ (42)	Corpus Luteum ☐ (1=left 2=right 3=none)	☐
Stomach ☐ (43)	Pancreas ☐	☐
Testis ☐ (44)	Lung ☐	☐
Ovaries ☐ (45)	Blubber ☐	☐
Uterus ☐ (46)	Blood ☐	☐
Female lactating? ☐ (1=yes 2=no 3=colostrum) (47)		☐
		☐
		☐

Fetus data*

Sex* ☐ (1=Male 2=Female) (48)

Fetus length (cm)* [.] (49–52)

Fetus weight (kg)* [.] (53–55)

Fetus color type: ☐

Fetus position (1=left horn 2=right horn) ☐

* Note: If fetus is less than 30 cm, leave in uterus and preserve. Do not sex and measure in field.

Photos

	Roll no.	Frame no.
Left lateral		
Ventral		
Other (explain)		

Electrophoresis samples

Heart ☐
Liver ☐
Kidney ☐
Muscle ☐

Fetus or unusual marks

Observer's name ☐

Date of dissection ☐ Time of dissection ☐

Notes on overleaf (1=yes 2=no) ☐

3.3.3 Marine Mammal "Off-Effort" Sighting

Marine mammal "off-effort" sightings are intended to gain information about marine mammals sighted other than those brought up in the fishing gear. Most marine mammal sighting data are valuable, whether or not you were deliberately looking for mammals. Thus, if a crew member points out a mammal to you, or if you merely glance up from your work and see a mammal, write it down, and record the information on the form (for complete instructions see Section 3.4.1).

3.3.4 Seabird Voucher Specimens

Overview

The primary objective for monitoring marine birds in the squid driftnet fisheries is to obtain accurate information on the incidental catch of species and numbers of individuals for selected commercial fishing vessels. From these samples, total incidental catch will be estimated for the fishery. A limited number of specimens and biological data will be collected to verify species and to supplement bycatch data for assessment of impacts.

The probability of a marine bird being caught in a driftnet is a function of many interrelated factors including: nets (type, size, location in water column, soak time); behavior of birds (feeding and foraging techniques); water conditions (sea state, temperature); size of bird; availability of prey (squid, fish, invertebrates); and physical condition of bird (molt, migration, health). The following pages are intended to provide a brief insight into marine birds and their environment in the squid driftnet fishing area, including instructions on how to identify them and collect related biological data.

Over 115 species of marine birds occur in the North Pacific Ocean and approximately 60% of these have at least a small chance of becoming entangled in a squid driftnet (Table 3-1). Their distribution and abundance is determined by a wide variety of physiological factors (breeding condition, molt, migration, hunger) and environmental factors (biotic and abiotic composition of the water, water movement, meteorology, sea floor topography, interactions with other animals including man, and location of breeding areas). Of particular importance are processes which influence prey abundance and availability.

Twenty three species of marine birds have been found in driftnets (Table 3-1), but only about half of these have been recorded with any frequency and only 4 occur in high numbers. Seabirds become entangled in nets by 1) running into them while swimming under water, 2) by reaching through or into nets with their heads or bills, or 3) by having the net thrown over them by rough waters. Albatrosses, for example, sit on the surface and reach into nets to a depth of up to 1.5 m. Shearwaters pursue prey under water and will become entangled deeper in the nets. Puffins will dive to even greater depths and may become caught in the deepest parts of the nets. Thus, 95% of these birds are caught in the upper 4 meters of nets set at the surface, and 60% are caught in the upper 2 meters. Only the albatrosses are thought to be actively taking prey from the nets, although most species are opportunistic in their feeding habits and will take what they can, when they can.

Table 3-1.-- Annotated List of Marine Bird Species in the Flying Squid Fishery.

Δ = High possibility of being caught in nets
▲ = Large numbers known to be caught in nets
▯ = Moderate possibility of being caught in nets
▮ = Medium numbers known to be caught in nets
o = Low possibility of being caught in nets
• = A few known to be caught in nets
* = Species with low, threatened or endangered populations

	ENGLISH NAME	SCIENTIFIC NAME	JAPANESE NAME
o	Short-tailed Albatross*	Diomedea albatrus*	Ahoudori*
▲	Black-footed Albatross	Diomedea nigripes	Kuroashi-ahoudori
▲	Laysan Albatross	Diomedea immutabilis	Ko-ahoudori
•	Black-browed Albatross	Diomedea melanophris	Mayuguro-ahoudori
•	Northern Fulmar	Fulmarus glacialis	Huruma-kamome
o	Tahiti Petrel	Pterodroma rostrata	Seguro-shirohara-mizunagidori
o	Phoenix Petrel	Pterodroma alba	Munaobi-shirohara-mizunagidori
•	Mottled Petrel	Pterodroma inexpectata	Madara-shirohara-mizunagidori
•	Providence Petrel	Pterodroma solandri	Hajiromi-zunagidori
o	Murphy's Petrel	Pterodroma ultima	Usuhajiro-mizunagidori
o	Kermadec Petrel	Pterodroma neglecta	Kawari-shirohara-mizunagidori
o	Herald Petrel	Pterodroma arminjoniana	Munahu-shirohara-mizunagidori
o	Hawaiian Petrel*	Pterodroma phaeopygia*	Hawai-shirohara-mizunagidori*
•	White-necked Petrel	Pterodroma externa	Oo-shirohara-mizunagidori
o	Cook's Petrel	Pterodroma cooki	Hajiro-shirohara-mizunagidori
o	Bonin Petrel	Pterodroma hypoleuca	Shirohara-mizunagidori
o	Black-winged Petrel	Pterodroma nigripennis	Haguro-shirohara-mizunagidori
o	Stejneger's Petrel	Pterodroma longirostris	Hime-shirohara-mizunagidori
o	Pycroft's Petrel	Pterodroma longirostris pycrofti	Usuhimo-shirohara-mizunagidori
o	Bulwer's Petrel	Bulweria bulwerii	Anadori
•	Streaked Shearwater	Calonectris leucomelas	Oo-mizunagidori
•	Pink-footed Shearwater	Puffinus creatopus	Shirohara-akaashi-mizunagidori
▮	Flesh-footed Shearwater	Puffinus carneipes	Akaashi-mizunagidori
▯	Wedge-tailed Shearwater	Puffinus pacificus	Onaga-mizunagidori

	ENGLISH NAME	SCIENTIFIC NAME	JAPANESE NAME
■	Buller's Shearwater	Puffinus bulleri	Minami-onaga-mizunagidori
▲	Sooty Shearwater	Puffinus griseus	Haiiro-mizunagidori
▲	Short-tailed Shearwater	Puffinus tenuirostris	Hashiboso-mizunagidori
o	Christmas Shearwater	Puffinus nativitatus	Ko-mizunagidori
o	Newell's Shearwater*	Puffinus townsendi*	(no Japanese name)
o	Black-vented Shearwater	Puffinus opisthomelas	(no Japanese name)
o	Audubon's Shearwater	Puffinus lherminieri	Seguro-mizunagidori
o	Wilson's Storm-petrel	Oceanites oceanicus	Ashinaga-koshijiro-umitsubame
o	Band-rumped Storm-petrel*	Oceanodroma castro*	Kuro-koshijiro-umitsubame*
o	Swinhoe's Storm-petrel*	Oceanodroma monorhis*	Hime-kuro-umitsubame*
●	Leach's Storm-petrel	Oceanodroma leucorhoa	Koshijiro-umitsubame
o	Tristram's Storm-petrel	Oceanodroma tristrami	Oo-suton-umitsubame
o	Matsudaira's Storm-petrel	Oceanodroma matsudairae	Kuro-umitsubame
●	Fork-tailed Storm-petrel	Oceanodroma furcata	Haiiro-umitsubame
o	Red-tailed Tropicbird	Phaethon rubricauda	Akao-nettaicho
o	White-tailed Tropicbird	Phaethon lepturus	Shirao-nettaicho
o	Masked Booby	Sula dactylatra	Aotsura-katsuodori
o	Red-footed Booby	Sula sula	Akaashi-katsuodori
o	Brown Booby	Sula leucogaster	Katsuodori
o	Pelagic Cormorant	Phalacrocorax pelagicus	Hime-u
o	Red Phalarope	Phalaropus fulicarius	Haiiro-hirecashi-shigi
o	Red-necked Phalarope	Phalaropus lobatus	Akaeri-hirecashi-shigi
●	South Polar Skua	Catharacta maccormicki	Nankyokuoo-touzokukamome
●	Pomarine Jaeger	Stercorarius pomarinus	Touzokukamome
o	Parasitic Jaeger	Stercorarius parasiticus	Kuro-touzokukamome
◗	Long-tailed Jaeger	Stercorarius longicaudus	Shirohara-touzokukamome
o	Herring Gull	Larus argentatus	Seguro-kamome
o	Glaucous-winged Gull	Larus glaucescens	Washi-kamome
o	Glaucous Gull	Larus hyperboreus	Shiro-kamome
●	Black-legged Kittiwake	Rissa tridactyla	Mitsuyubi-kamome
o	Red-legged Kittiwake	Rissa brevirostris	Akaashi-mitsuyubi-kamome
o	Sabine's Gull	Larus sabini	Kubiwa-kamome
o	Common Tern	Sterna hirundo	Ajisashi
o	Arctic Tern	Sterna paradisaea	Kyoku-ajisashi
o	Aleutian Tern	Sterna aleutica	Koshijiro-ajisashi
o	Gray-backed Tern	Sterna lunata	Nanyo-umamijiro-ajisashi
o	Sooty Tern	Sterna fuscata	Soguro-ajisashi

	ENGLISH NAME	SCIENTIFIC NAME	JAPANESE NAME
●	Thick-billed Murre	Uria lomvia	Hashibuto-umigarasu
o	Common Murre	Uria aalge	Umigarasu
●	Ancient Murrelet	Synthliboramphus antiquus	Umisuzume
o	Cassin's Auklet	Ptychoramphus aleuticus	Amerika-umisuzume
o	Parakeet Auklet	Cyclorhynchus psittacula	Umioomu
o	Crested Auklet	Aethia cristatella	Etorofu-umisuzume
o	Least Auklet	Aethia pusilla	Ko-umisuzume
■	Horned Puffin	Fratercula corniculata	Tsunomedori
■	Tufted Puffin	Fratercula cirrhata	Etopirika

General Procedures

Written documentation of field studies is an essential part of good research. It is expected that observers in the squid driftnet observer program will maintain a field notebook containing careful notes on marine birds they observe. In addition, each observer is to collect the first specimen of each species recovered from the nets during the course of each cruise to be used as voucher specimens. The following information is provided to describe the procedures for collecting and preparing the specimens.

IN THE FOLLOWING PAGES, THE TEXT AND ILLUSTRATIONS ON FREEZING, SKINNING AND SEXING SPECIMENS HAVE BEEN REPRODUCED BY PERMISSION OF THE SMITHSONIAN INSTITUTION PRESS FROM PRELIMINARY FIELD GUIDE TO THE BIRDS OF THE INDIAN OCEAN, G.E. WATSON, R.L. ZUSI, AND R.E. STORER. SMITHONIAN INSTITUTION, WASHINGTON, D.C. 1963. MATERIAL ADDED BY US IS ENCLOSED WITHIN DOUBLE BRACKETS (()).

Preparation of Specimens

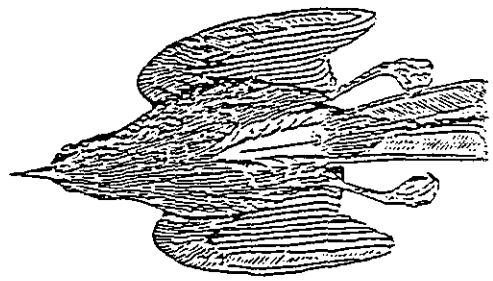
((Labeling - A waterproof label should be attached to every specimen that is to be retained. This label should be filled out in waterproof ink or pencil and include the following information:

Name of Collector
Collection Number - The first bird collected will be assigned an ID number consisting of the observers initials followed by 001 (JRP001)
Date of Collection
Location of Collection (Latitude & Longitude)
Set Number
Water Temperature
Age, Sex, Molt, Stomach Contents, Band Number if any))

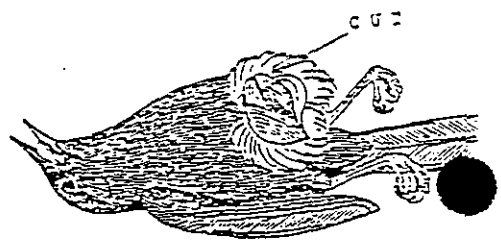
Freezing Specimens - Freezing an entire specimen is the simplest and fastest method of preservation and also permits maximum freedom for its subsequent utilization. Specimens should be labelled completely, placed in a polyethylene bag which is closed by a thread or string tied around the mouth, and frozen as soon as possible. Preferably each specimen should be in an individual bag. Sharp bills and claws should be wrapped in cotton to prevent their piercing the bag ((and a cotton wad should be placed in the throat)). Once frozen, birds should not be thawed until ready for preparation by another method ((an alternative to freezing specimens is *to prepare salted skins by the following method*)).

Skinning Specimens - Before skinning, place a wad of cotton in the throat and plug the nostrils (large birds), vent (anus), and other large holes or damaged eyeballs to prevent blood from running out and soiling the plumage. Prepare a complete label and also enter the specimen in your field catalogue

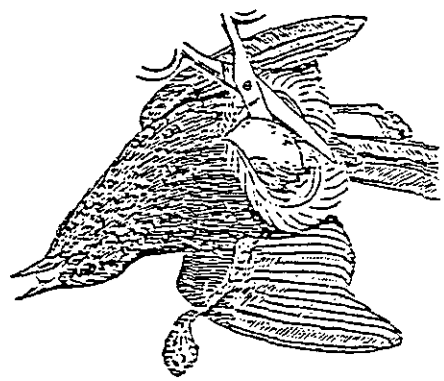
INITIAL CUT -- Lay the bird on its back with its head to your left (if you are left-handed, reverse the position) and part the feathers on the lower breast and belly to reveal the bare skin (birds brooding eggs will have the belly skin wrinkled and vascularized into a brood patch; record on label). Seabirds and ducks may have the feather covering nearly continuous across the breast and abdomen. Cut the skin of the belly and lower breast back to the vent. Take care to avoid cutting into the musculature of the abdomen and spilling its wet and bloody contents onto the plumage. Sprinkle absorbent ((e.g., corn meal)) along the cut to dry any blood or body fluids.

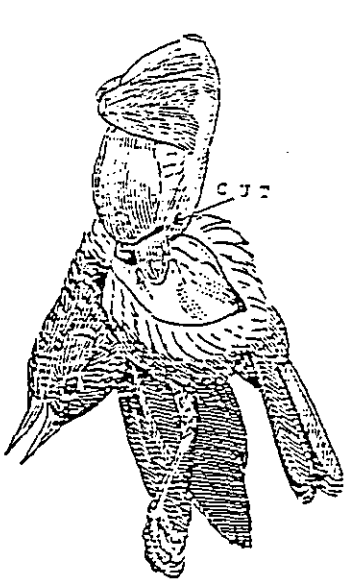


LEGS -- Separate the skin from the belly, breastbone, and lower sides with a pair of forceps and your fingertips, gradually exposing the knee through the opening cut. With the knee free of its covering membrane, clip the joint with scissors (small bird) or disjoint with scalpel (large bird). Strip the muscles from the bone down to the scutellated portion of the tarsus and discard the meat. Turn the leg right-side out and repeat the other side. During this entire process, absorbent (cornmeal, sawdust) should be used liberally to dry up any blood. Absorbent will also keep your fingers dry.

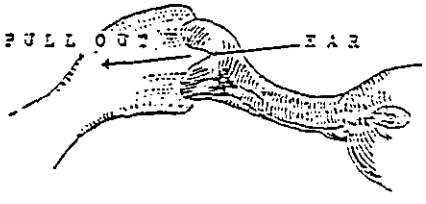


TAIL -- Carefully push the skin off the body on either side of the tail so that only the quills are attached. Care at this point will prevent loss of rump feathers. Sever the tail with scissors, leaving the last bone and some muscle attached, but AVOID CUTTING THE SKIN ON THE LOWER BACK.

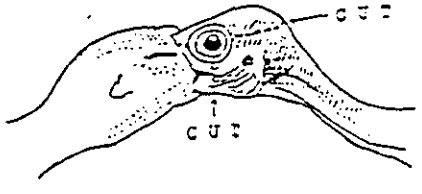




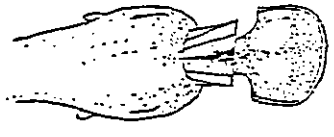
BODY AND WINGS -- Push (do not pull) the skin off the rump, back, and breast with your thumbnails and forefingers so that the skin is inverted over the body and the shoulders are exposed. With scissors or scalpel cut off the wings at the shoulders. When you cut through the brachial vein, there may be some blood flow. Use absorbent liberally.



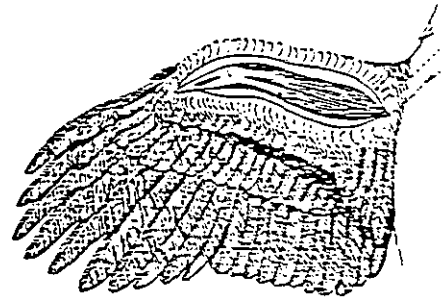
HEAD AND NECK -- Push (do not pull) the skin up the neck and carefully over the skull to avoid tearing it. The membranous pieces of skin penetrating the skull on either side are the ears. They should be pulled out (forward) with forceps. Continue pushing the skin forward until the membrane joining the eyelids and the skin appears. the membrane over the eye appears darker than the eyelid and the surrounding skin. Cut this membrane carefully with a sharp scalpel, leaving the eyelid intact. Free the skin from the base of the bill.



CLEANING THE SKULL -- Cut the lower and upper jaws and the back of the skull to the eye sockets on either side. Lift the skull cap free of the brain and eyeballs (with care and practice, the operation will leave no further cleaning of the skull necessary on small birds). Skulls of young birds are not fully ossified so that when the skull is held up to the light, it shows translucent "windows" (record on label). Seabirds usually have a fleshy salt gland over each eye which should be removed.



WINGS -- Clean the wings by exposing and removing the meat from the forward surface of the forearm along with the humerus and its attached muscles. DO NOT STRIP THE SECONDARY FLIGHT FEATHERS FROM THE ULNA. On small birds the muscles may be removed from the inside, but larger and long-winged birds will necessitate another cut from the outside on the underside of the forearm to expose the muscle to be cleaned off. This will facilitate putting the skin together later.



CLEANING TAIL AND PREEN GLAND -- The meat and fat still attached to the tail should be removed. At the base of the tail and opening on the back are two greasy oil (preen) glands. These should be completely removed. TAKE CARE NOT TO WEAKEN THE ATTACHMENT OF THE TAIL FEATHERS.

REMOVAL OF FAT -- Remove any meat and fat remaining on the inside of the skin. In particularly fat birds, such as seabirds, ducks, and shorebirds, the inside of the skin must be scraped with a scalpel. Always scrape from tail to head to avoid cutting the skin. Do not get grease on the feathers; use absorbent liberally (heated cornmeal is especially effective). Clean thoroughly; fat left on the inside of skins will leak out onto the surface soiling the completed skin.

LARGE AND GREASY BIRDS -- Seabirds which are especially fat may be skinned out, salted flat, and sent in from the field in that condition. This is especially desirable if the birds are greasy, as they can be cleaned more efficiently in the museum than in the field. Rub fine salt thoroughly into the flesh side of the entire skin, including the head and neck and be sure to work it in around the base of the bill, into the wings, base of the tail, and the openings on the feet through which the tendons have been drawn. Turn the skin right-side out, smooth the feathers, and dry will in the sun for a brief period if needed. Pack

separately from made-up skins. In large birds, turn the head on the breast to make a more compact specimen.

3.3.5 Turtle Biological Sampling

I. Overview

The following guidelines describe the procedures for gathering biological information from sea turtles entangled in the driftnets during observed section retrievals. Some procedures apply to all turtles observed, including those which drop out or are lost without being retrieved onto the deck. Others apply only to turtles brought aboard in the nets. Procedures also vary among turtles retrieved in the nets, depending on whether they are dead or alive.

Every observer will be responsible for observations of sea turtles, including counting, identification, photography, length measurements, tagging and releasing, salvage, and dissection.

Every turtle entangled in observed net sections, whether dropping out or being retrieved aboard the vessel, should be sampled.

Since sea turtle encounters will be relatively rare, every effort must be made to collect data from them when the opportunities arise. A single "Sea Turtle Sampling Form" (see page ??), should be completed for every sea turtle in or dropping out of the net. In addition, whenever possible observers should note in their field logbook any sightings of sea turtles not entangled in the driftnets, but swimming in the vicinity of the nets or the driftnet vessel.

Because data on sea turtles will be relatively meager, it is essential that they be accurate. Whenever a data element cannot be accurately determined, this fact must be indicated. Photographic documentation will greatly assist in verifying species identifications and carapace lengths, and should be done routinely, even when observers are confident of their field identifications and size measurements (Section 3.3.6).

In addition, any sightings of sea turtles swimming free of the net (possibly associated with the net but not entangled in or dropping out of the net) should be recorded in the observer's log whenever feasible. In such instances, the date and other pertinent facts should be noted, as well as a species identification and approximate size.

II. General Procedure

Turtles should be brought on board whenever possible. However, large leatherbacks should not be hauled aboard if they are alive. Even when they are dead they will typically be cut free from the net by the vessel's crew as they are brought alongside the vessel.

Turtles brought aboard alive should be handled very carefully and placed in a safe place on the deck to avoid injury. Biological processing of the turtles should be completed as soon as possible, after which the turtles should be returned to the sea. Typically, the observer will have to wait until the section retrieval is completed before the biological work can be done.

NOTE!!! - A turtle may appear to be dead when it is only unconscious as a result of forced submergence in the net. An unconscious turtle may "come alive" after an hour or more of being out of the water in a protected area on deck. Therefore, prior to salvaging and freezing a "dead" turtle, or dissecting its stomach, every effort should be made to verify that it is in fact dead.

The following instructions outline the procedures to be followed for each particular situation. Further details are given in subsequent sections.

A. Turtles not retrieved - In the case of turtles which are not retrieved on deck the observer should:

- Identify each turtle entangled in observed net sections but not brought aboard, whether due to dropping out or being freed by the crew; note condition of the turtle (dead, alive, or unknown);

- If possible, estimate the carapace length of each turtle;

- If feasible, document species identifications with photographs (Section 3.3.6);

B. Turtles retrieved **DEAD** - in the case of all dead turtles hauled aboard in the net, the following procedure should be followed (this applies to all observers, including those from the U.S., and all turtle species):

- Remove the turtle from the webbing.

- Identify the turtle to species;

- Complete a series of 3 photographs from dorsal, ventral, and frontal perspectives; in the case of leatherback turtles a single dorsal photo will suffice (Section 3.3.6);

- Measure the carapace length (see instructions below);

- Check flippers for tags; if any tags are found on a **DEAD** turtle, record their identification numbers and inscriptions. If the turtle is kept and frozen leave the tags in place; otherwise, remove the tags and place them in a plastic specimen bag with a standard specimen label and return them to the NMFS Honolulu Laboratory with the data at the end of the cruise.

- If adequate freezer space is available and the turtle has a carapace length less than 35 cm, place the turtle in a plastic specimen bag, include label, and freeze the turtle whole.

- OR -

- If whole turtle cannot be salvaged, then dissect and preserve its stomach or a sample of its stomach contents (see following instructions).

C. Turtles retrieved **ALIVE** - in the case of turtles hauled aboard alive, the following procedures should be followed:

- Remove the turtle from the webbing carefully and place it in a safe, protected area of the deck;

- Identify the turtle to species;

- Complete a series of 3 photographs from dorsal, ventral, and frontal perspectives (Section 3.3.6);

- Measure the carapace length (see instructions below);

- Check turtle for existing tags; if any tags are found, scrape them clean of any fouling growth and record their identification numbers and inscriptions; note color of tag and whether it is metal or plastic;

- Using the special tag applicator, apply a new number tag to the posterior margin of each front flipper, i.e., two tags to each turtle (see following instructions). Apply new tags even if old tags are already present;

- Then carefully release the turtle overboard in such a manner that it will not be swept into the ship's propellers or become entangled in the net.

NOTE!!! - United States observers cannot measure or tag leatherback or hawksbill turtles because the required Federal permit is still pending as of May 1, 1990. Such a permit is not needed by observers from Canada, Japan, Korea, or Taiwan; hence, observers from these countries should follow the measuring and tagging procedures indicated above on all species. U.S. observers dealing with live leatherback and hawksbill turtles retrieved on deck should proceed as follows:

- Remove the turtle from the webbing;

- Identify the turtle to species;

- Take a set of photographs (Section 3.3.6);

- Estimate the turtle's carapace length;

- Check turtle for existing tags; if any tags are found record their identification numbers and inscriptions;

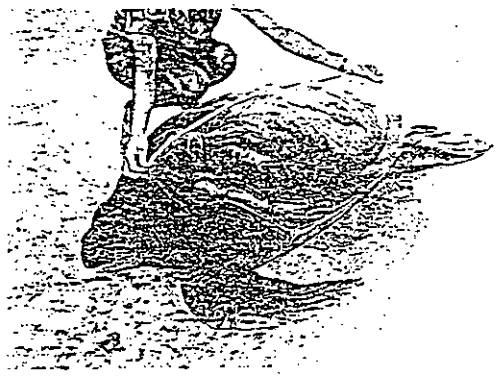
III. Carapace length measurements

- Place the turtle on the deck with its ventral side down;

- Using a flexible tape measure, determine the length of the carapace (upper shell) along the midline of the back between the two points as shown. Be sure the tape follows the curve of the back.

- Record the carapace length to the nearest lower centimeter.

- In the case of turtles which are not retrieved on deck, simply estimate the length of the carapace as accurately as possible, or indicate the likely range for the carapace length.

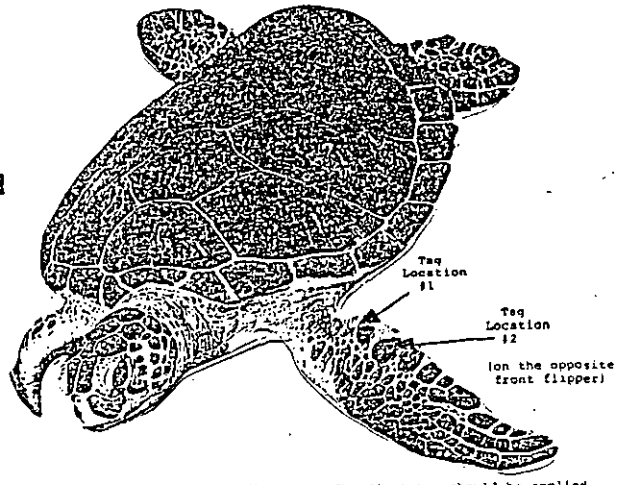


Correct method of measuring the length of the carapace (upper shell) using a flexible tape. Be sure the tape follows the curve of the back along the midline between the two points shown.

IV. Tagging method

All turtles retrieved alive will be double-tagged prior to their safe release. The only exception is that U.S. observers are not authorized to tag hawksbills and leatherbacks until being notified that a permit has been obtained. Canadian, Japanese, Taiwanese, and Korean observers should tag all species of turtles that are retrieved alive.

The tags that have been supplied for turtles are made of corrosion resistant Inconel alloy. They bear the mailing address of the University of Hawaii. Each turtle will have one tag applied to the posterior (trailing) edge of the LEFT front flipper, and another tag applied to the posterior edge of the RIGHT front flipper. The tags will be applied at different locations on each front flipper. If one or both of these recommended locations has been injured or is missing on the flipper, any alternate site on the posterior edge may be chosen to attach the tags. If a crew member is able to assist, it is highly recommended that the observer have them help by holding the turtle and it's flipper motionless while the tag is applied.



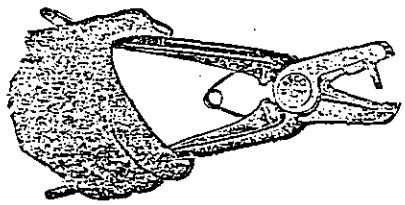
Locations to apply tags to the front flippers. The first tag should be applied to Location #1. The second tag should be applied to Location #2 on the opposite flipper.

IF APPLICATORS HAVE BEEN SUPPLIED:

- The tag should be correctly loaded into the mechanism. Care must be taken to be sure that the slot (hole) in the tag matches up with the "cup" in the applicator. A tag that is loaded upside down will malfunction and be ruined. Any ruined tags should be recorded, saved, and returned along with the unused tags.

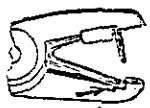
- After locating the proper tagging site on the turtle's flipper, the applicator with loaded tag should be squeezed together so that the point of the tag pierces the flipper and locks fully. NOTE: The applicator must be squeezed with considerable force in the final closed position in order for the tag point to pass through the slot and bend over COMPLETELY.

- Carefully inspect each tag after application to make absolutely certain it is fully locked. An incompletely locked tag with the point sticking out will be liable to entanglement in a net.



Applicator with properly loaded tag ready to be applied.

All tags should be carefully inspected after being attached with the special applicator.



Be sure the tip of the tag goes into the "cup" of the applicator.

Special tag applicator with properly loaded tag.

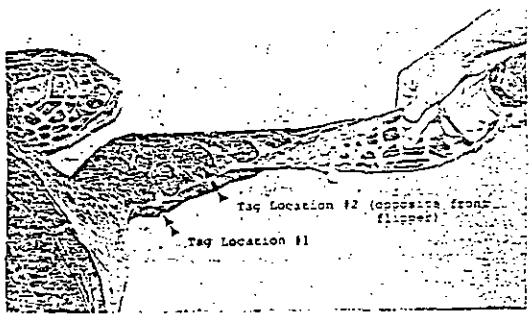
IF APPLICATORS HAVE NOT BEEN SUPPLIED:

- Locate the tagging sites (same as previously illustrated) and carefully pierce through the flipper (dorsal to ventral) using the small scalpel or similar knife supplied. This incision only needs to be wide enough to insert the point of the tag so it will pass through the flipper.

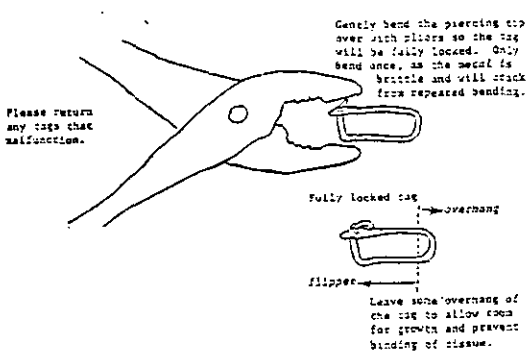
- Using the pair of pliers supplied, carefully bend the point of the tag over into its fully locked position.

- All tags should be applied in such a manner so as to have some (about 20%) "overhang" beyond the posterior edge of the flipper (see diagram). This will provide space to accomodate the flipper as the turtle grows larger.

- Be sure to accurately read and record both tag numbers before releasing the turtle.



Use a scalpel or other small knife to pierce the flipper. Insert tag and lock tip using pliers, as shown below.



Method and locations to apply tags without special applicator.

V. Salvaging

If a dead sea turtle retrieved on deck is very small (carapace length less than 35 cm) and adequate freezer space is available, place the turtle in a plastic bag, include a completed specimen label, and put the turtle in the freezer. Freezing of these specimens should be accomplished as soon as possible after they are processed by the observer.

VI. *Dissection and freezing of stomachs or gut contents*

For dead sea turtles with carapace length greater than than 35 cm but less than 70 cm the following procedure should be followed:

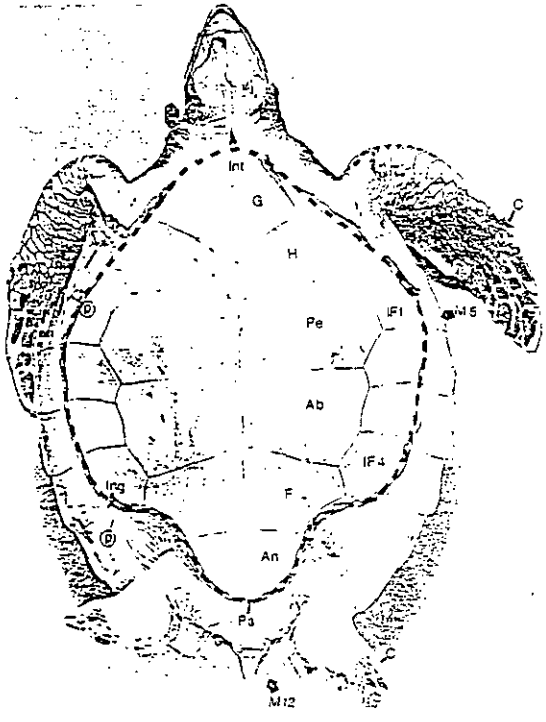
- Place the turtle on its back and make an incision around the edge of the ventral surface (plastron) with a knife or scalpel, exposing the internal organs. Find stomach and remove it by cutting it free from the esophagus (anterior end) and intestine (posterior end).

- Place the whole stomach in a plastic whirl-pac bag, include a standard specimen label, close and seal bag, and freeze. On Japanese or Korean vessels only, use a plastic syringe to inject 25-50 cc of 10% formalin into either end of the stomach before bagging and freezing. Tie off both ends before cutting.

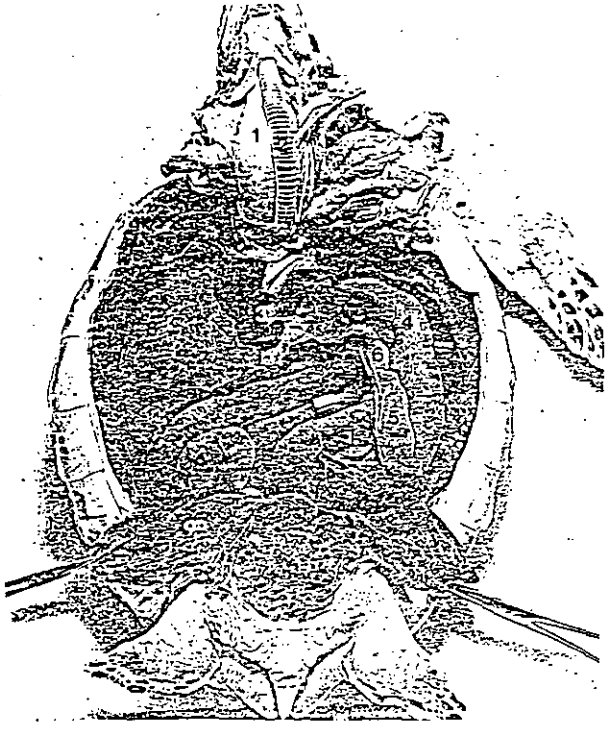
For dead sea turtles with carapace length length greater than 70 cm the following procedure should be followed:

- Open the plastron as described above, exposing the internal organs.

- Open the anterior portion of the stomach (near the esophagus) and remove a representative (random) sample of the gut contents (maximum of about 0.5 kg), place sample in whirl-pac bag, enclose specimen label, close and seal bag, and freeze. On Japanese or Korean vessels only, inject 25-50 cc of 10% formalin into the bag using a plastic syringe before sealing the bag and freezing it.



Ventral view of hardshell turtle with dotted line showing where to make incision in order to remove plastron. Muscle under plastron will need to be cut away to expose the stomach.



1. esophagus
2. trachea
3. heart
4. anterior stomach
5. pyloric stomach
6. small intestine
7. left lobe of liver
8. right lobe of liver
9. peritoneum

Ventral view of hardshell turtle showing location of stomach (4 and 5).

VII. Sea Turtle Sampling Form

The attached "Sea Turtle Sampling Form For High-Seas Driftnet Observers" should be completed by all observers for each turtle entangled in the observed net sections. In the first section of the form the observer should record basic information for ALL turtles encountered:

- Vessel name
- Observer name
- Operation number
- Section number
- Species of turtle (coded)
- Condition of turtle (dead, alive, lost-condition unknown)
- Carapace length of turtle (cm)
- Turtle retrieved? (circle YES or NO)

The second section on the form should be completed for all turtles RETRIEVED aboard the vessel. First, the turtles should be checked for existing tags, then processed as indicated above, depending on whether they are dead or alive. The observer should complete all pertinent questions, circling YES or NO as appropriate. If tags are already present or added by the observer, the tag numbers and other data should be entered in the spaces provided.

SEA TURTLE BIOLOGICAL SAMPLING FORM FOR HIGH-SEAS DRIFTNET OBSERVERS

Complete Following Information For ALL Turtles

Vessel		Species		
Observer		Condition		
Operation		Length		
Section		Retrieved?	Yes	No

Complete Following Information For RETRIEVED Turtles

Tags present?		Tag Number	Tag position/color/type
No	Yes		

TURTLE DEAD

Turtle kept?		
Yes		No
Whole turtle salvaged?		
Yes	No	

Gut preserved?	
Yes	No

TURTLE ALIVE

Turtle released?	
Yes	No

Tags applied?	
Yes	No

Tag Nos.

Comments: _____

_____

_____

3.3.6 Photographic Documentation

Overview

Observers will be supplied with film and cameras for the purpose of documenting aspects of their cruise. Below are guidelines for the types of photographs desired and suggested mechods to use for obtaining good quality photographs usable for scientific purposes. You will be supplied with sufficient film to cover these objectives although you should be careful not to waste film. You should remember that photographs are considered data and thus are government property and must be handed in after the cruise unprocessed. We will process the film during debriefing and copies of certain pictures may be available by special request.

The observer should keep careful records of photographs taken during the cruise. In your trip report keep a log of all photographs taken by roll number, shot number, date, and activity. The first shot of each roll should be taken of a white sheet of paper with the following information clearly written: roll number, vessel name, license number, observer name, and date.

General Photographs

Photographs of field operations (especially showing people and equipment in action) are important. These are often very useful in documenting working conditions and field techniques. They also provide quality to briefings, reports and publications.

Birds

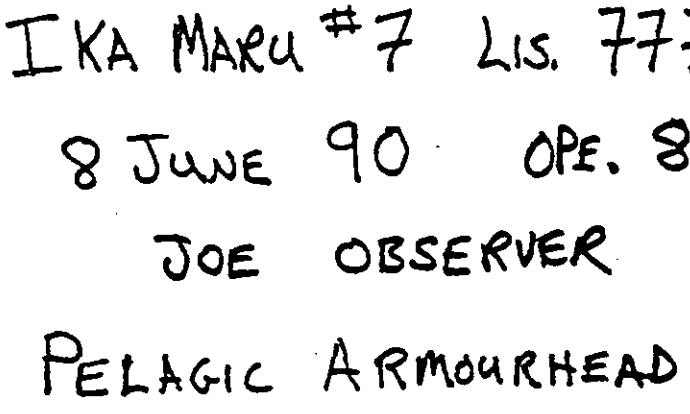
Documentation of species occurrence is possible by using photography. This is best accomplished in the following manner. Lay the bird on its back on a clean surface (in a few species, such as storm-petrels and small Pterodroma, the dorsal surface may also be distinctive and the bird should be laid on its belly -- in some cases two pictures may be needed). The head should be turned on its side to show a profile of the bill. One wing should be spread out to show the underwing or dorsal color pattern. A millmeter ruler should be placed near (vertically as well as horizontally) the head to provide scale in the photograph. A card with the following information should be in the field of view: Ship, haul and section number; date; latitude and longitude; photographers name; and specimen number (the latter is needed since two pictures may be taken of the same bird). Specimen numbers should be kept in a field notebook. It is a good idea to have more than one species in each picture for comparative purposes, especially if one of the species is easily recognized.

Lighting is an extremely important consideration. Patterns of light and dark are critical to the identification of many species of marine birds. The structure feathers affects the way light is reflected from them so that in a photograph grey can look black and black can look silvery. The underwings of sooty and short-tailed shearwaters can look identical in some light. Direct light is best and shadows should be avoided.

Squid, Marine Fish, and Salmon

Many of the fish species encountered, especially tunas and billfishes, may seem very similar to each other in appearance; hence, misidentifications are quite possible. To help verify the identifications made at sea all observers should try to take representative photographs of all fish species captured during the course of the cruise. "Type" photos should be documented in the observer's photo log. Photo IDs should be taken of as many different species encountered as possible, including those not among the 24 basic, profiled species. The photographic record will help experts to later identify rare or unusual species.

When taking photographs of ifsh it is important to lay the animal on it side (usually right side down) on a madium dark surface in an area where there is good outdoor lighting. Include in the photograph a scale for size reference and a labeled card noting vessel name, date, operation, your name, and tentative identification. Photographs should be taken of specimens while fresh, before their color fades.



Turtles

Whenever feasible, the observer should photograph all turtles brought aboard the vessel. The following procedure should be used:

- Place the turtle on the deck in a well-lighted area. (Wait until sufficient daylight is available unless using an electronic flash.)

- If a live turtle is too active and a crew member is available to assist, ask him to help by restraining the turtle while it is being photographed. If the turtle moves suddenly during a photo, retake the photo. Turtles have been known to bite, so exercise caution when handling them.

- Focus carefully and provide proper exposure. If possible, wipe the turtle dry with a rag to reduce glare which may obscure key anatomical details needed to verify identification.

- Be sure the turtle fills up the picture frame.

- Be sure to record appropriate information in the photo log, and place a white 3x5 card with proper identification in the picture. The 3x5 inch card will also indicate relative size of the turtle.

- If feasible, take dorsal and ventral views of the whole turtle, and a close-up frontal view of the head. With leatherbacks, a single overall view of the turtle will be sufficient.

Even if the turtle cannot be hauled aboard, if it is feasible to photograph it alongside the vessel, either while in the net or free in the water, identification will be greatly assisted.

Marine Mammals

Photograph each porpoise in accordance with the following guidelines:

1. One, full frame, left lateral view and one full frame ventral view, i.e. tip of rostrum near one margin of the frame and the flukes at the opposite margin.

2. All photos must be taken at right angles to the animal. In other words, the animal must be placed squarely in front of you.

3. Position animals against a contrasting background and/or where direct sunlight does not illuminate the body. Avoid photographing toward bright sunlight. Wipe excess moisture off the body surface photographed to decrease reflected light from the flash unit.

4. Within the frame of each photo, place a specimen identification card. This is a 3" x 5" colored index card, listing the vessel name and number, year and personal specimen number. EXAMPLE:

IKA MARU #7 1990

JOO Ø12

LISSODELPHIS BOREALIS.

5. For fetuses, photograph one full frame view of left lateral side. Be sure to place a Photo Identification Card in the frame. Note on the LHF with sex, length (to the nearest 0.1 cm) and weight (to the nearest 0.1 kg).

3.4 SPECIALIZED BIOLOGICAL SAMPLING

3.4.1 Marine Mammal Sighting Surveys

General

Sighting data are used for estimating the abundance of marine mammal species, their distribution and movements. These data are extremely important; the quality of the data is dependent upon the observer's care and concern. Marine mammal sighting surveys are to be conducted whenever the vessel is in transit for extended periods (more than half an hour) and conditions permit (up to a Beaufort 4-5). Once fishing operations begin, sighting survey work is of lower priority than observing the retrievals. On days when you are not observing a retrieval and sighting conditions are good, schedule some sighting survey time if the vessel is in transit.

Suitable sighting conditions are characterized by sea states with minimal chop, and visibility at least one kilometer ahead. This includes Beaufort stages 0-4 with unrestricted visibility or visibility conditions between levels 1 and 4 (see Appendix 3). During poor weather or visibility conditions 5 or 6 do not attempt any sighting since the quality of data is likely to be poor.

Limit concentrated sighting effort to one hour intervals with a break in between to avoid fatigue. The observations should be made from the flying bridge or other elevated position. The bridge generally is an inferior sighting position and should not be used.

It is important that species identifications be accurate. When you are uncertain of an identification, note this on the Sighting Form. Record the information and characteristics used to make the identification in detail.

Note if more animals/groups appeared after you sighted the first animals or group. Note how you first became aware of the presence - by roostertails, slow rolling, etc.

Note if all animals disappear at once or in small groups.

Note whether the animals come to the vessel (attraction) and if so, to the bow, stern or some other location, or alter course away from the vessel (avoidance).

Note the behavior of the animals in objective terms. Observations on their behavior will help us understand their reactions to vessels and gillnets and may help us find ways to reduce the number of entanglements. Be specific as possible but be careful not to interpret or anthropomorphize their behavior.

If marine mammals are sighted when the boat is not in transit, record the sighting but note on the bottom of the Sighting Form that it is "off effort" and indicate what the vessel mode was, i.e., during netset, retrieval, or some other time.

Marine mammal sighting data must include effort data in order to be useful in estimating abundance and density of the species. Remember to end a leg and start a new leg of effort when there is a significant change in weather, visibility, ship's course, ship's speed or watch personnel.

If you encounter any difficulties with the Sighting or Effort forms, refer to the following pages provide for detailed instructions. The best insurance against misinterpretation is to become completely familiar with all forms and instructions during training.

Description of Sighting Platform

There are several different types of vessels in the squid fishing fleet. The suitability of the upper bridge, bridge, and bridge wings for sighting surveys may vary. In your log book, write a description of the sighting platform or platforms that you use, including any obstructions or restrictions on your field of view, such as poles, search lights, etc. Also include a drawing of the view with positions of obstructions. This will help in analysis of the data and in placement of future observers for sighting surveys.

Observations of Discarded Webbing

If while conducting sighting surveys, you sight any floating webbing, record the following information:

a) Date and time
b) Position (Lat/Long) (of vessel)
c) Type of webbing (e.g., gillnet, trawl net)
d) Approximate mesh size (if possible), color of materials and any other details
e) Size of discarded net (include dimensions of percentage seen and indication of whether you feel more was below the surface)
f) Describe any entangled marine organisms (including marine mammals, fish, birds, or seaweed)
g) Describe how you saw it (e.g., floating by, or discarded from vessel by crewman). Record the sighting on a Marine Mammal Sighting Form just as though it were an animal. The species block and behavior codes should be left blank.

Dead Reckoning

The latitude and longitude of marine mammal sightings will need to be estimated by dead reckoning. The information that you have will be the latitude and longitude at the beginning and ending of the transect, and the times at the beginning, sighting, and ending. The position of the sighting can be estimated by,

$$A = \frac{ts-t1}{t2-t1}$$

$$L_s = L_1 + A * (L_2 - L_1)$$

$$Lo_1 = Lo_1 + A * (Lo_2 - Lo_1)$$

where,

L_1	Latitude at beginning of transect
Lo_1	Longitude " "
t_1	time " "
L_2	Latitude at end of transect
Lo_2	Longitude " "
t_2	time " "
L_s	Latitude at sighting
Lo_s	Longitude at sighting
t_s	time of sighting

Marine Mammal Sighting Form

NOTE: - All numeric entries will be right justified with leading zeros included.

* - Do not fill in boxes preceded by an asterisk except as directed.

- -

1. NAME - In the upper left hand corner of the log, write the observer's and vessel's name.

2. DATE (7-12) - Note proper sequence.

   TIME (13-16) - Time of sighting is logged when the animal is first seen. All times are logged in local ship time and in military fashion. Record the time zone in boxes 60-62.

3. LATITUDE (18-23) - To tenths of minutes, if obtained from SAT system, or to nearest NAV minute if DR'ed. Place N in box 23.

4. LONGITUDE (24-30) - To tenths of minutes, if obtained form SATNAV system, or to nearest minute if DR'ed. Place E or W in box 30 depending on which side of the 180th meridian the sighting occurs.

5. SPECIES (33-34) - Write in both the common and scientific name of the animals. If more than one species are sighted at the same time, note the association (if any) in the comments section and fill out a separate sighting form for each species. Cross-reference sighting records in comments (Col. 64-80).

   Do not enter a species name unless you are absolutely positive. If you are least bit unsure of the animal's identity, enter as "unident. large whale", "unident. porpoise", etc. remember that an erroneous identification is worse than none at all. You might give your "best guess" and explain why think it might be that species and not another.

   Important things to look for when attempting to make an identification are: (Note and circle characteristics on back of Sighting Form)

   1. Shape and size of dorsal fin and its position on the body. If possible, also note size and shape of tail and flippers.

2. Length. Size is difficult to estimate at sea, so it is convenient compare unfamiliar animals with a species with which you are familiar. For example - "about size of pilot whale", or "slightly smaller than bottlenose dolphin".

3. General shape of body (slender or robust).

4. Shape and size of snout. Is it long or short (estimated length in inches)? Is there a definite break between snout and forehead? Is the forehead markedly bulbous?

5. Color pattern on fins and body (stripes, spots, patches, mottling, etc.).

6. Shape, location, and direction of spout. Is it single or double? Where is spout located on head?
Does it lean forward or go straight up?

7. Scars and scratch marks.

8. Dive times - Length of time between dives, blows before diving, general shape of blow (tall and thin vs. short and fat, etc.), and did animal show flukes when diving?

Table 3-2 contains Species Codes.

6a. CONFIDENCE INTERVAL - Occasionally an observer will indicate that he/she saw 10 animals ± 2. Enter the following codes which best characterize the "confidence interval" of the sighting:

Code	Description
0	No error
1	plus or minus one animal
2	" " " two to three
3	" " " four to six
4	" " " seven to 12
5	" " " 13-35
6	" " " 36-75
7	" " " 76-100
8	" " " 101-1000
9	represents a minimal estimate of number of animals seen (e.g., at least 10 animals)

6b. NUMBER SIGHTED (37-40) - If unable to count the animals, estimate the number seen in terms of a range (e.g., 5 ± 1). For Dall's porpoise, note if you see more roostertails than the actual number of animals that come to the boat (there is evidence that schools may split up).

7. INITIAL SIGHTING CUE - Record primary sighting cue observed. For Dall's porpoise, the most frequently observed cues (and associated codes) are as follows:

01 - Body
08 - Bow riding
09 - Porpoising
82 - Jug Handling
91 - Roostertailing
92 - Slow-rolling
93 - Riding stern wake
94 - Surface splash
98 - Blow

Additional notes on behavior can be made in the comments field and in the "Additional Information" section on the back of the form.

8. ANGLE FROM BOW (47-49) - Observers should concentrate on the area from amidships forward to the bow on both sides. Pay particular attention to record the sighting at its initial location with reference to the transect line. Occasionally, animals approach vessels from the stern, so quickly scan the area aft of the beam every few minutes. Consider the ship a 360 degree circle when recording sighting angle; dead ahead being 000' and dead astern being 180'. Round to the nearest degree.

9. INITIAL SIGHTING DISTANCE - (50-52) - Note when in nautical miles, yards, or meters - whichever you are most comfortable with. Convert to 10's of meters and place in boxes 49 - 51.
Remember that all boxes are right justified (e.g., 100 meters = 10 in boxes 50 - 51).

10. VISIBILITY - Note in miles, if good weather, or in meters, if poor (e.g., fog).

11. SEA STATE - Beaufort Scale: See Appendix 3.

12. WEATHER - Rain, fog, blue skies, overcast, etc.

13. VISIBILITY CODE - Codes are in Table 3-3.
Note that this code reflects your ability to see animals.

14. SEA SURFACE TEMPERATURE (54-56) - In degrees Centigrade (round off to nearest whole degree). If below freezing, place a - in box 54. Temperature is placed in boxes 55-56. This can be obtained from engine inlet temperature (see Appendix 4 if in Fahrenheit.

15. PLATFORM CODE (57-60) - For squid driftnet vessels use 1516.

16. TIME ZONE (61-63) - See item 2, TIME.

17. IDENTIFICATION BEHAVIOR; COMMENTS - This section is one of the most important parts of the observation. Everything that you observed about the animal and used to identify it should be entered. Be liberal with sketches! Use as much room as you need to get everything down (the back of the sheet, if necessary). In addition to details of the animal's appearance, note:

    1. Kinds and numbers of other associated animals (fish, birds, squid, mammals, etc.) and their behavior.

    2. *Anything else you think might be pertinent.*

    Remember, if you identify the animal, say how you did it. (e.g., Sperm whale - 35 ft., large square head, no snout, spout at end of head and leaning forward).

    Be generous with narrative of animal behavior. If there are several animals, are they in a tight school, a loose school, or scattered either single or in small groups? Do the animals approach the vessel and ride the bow wave? Note their diving behavior. How many times do they blow when they come to the surface? Do they raise their tail flukes when they dive after their last blow? How long do they stay down between each series of blows? Do they leave "tracks" or swirls on the surface when they are submerged? Do they jump (breach) clear of the water? If so, do they jump in a smooth arc or do they sometimes belly-flop, somersault, or spin?

18. ADDITIONAL INFORMATION (optional) - See sighting survey supplement for details.

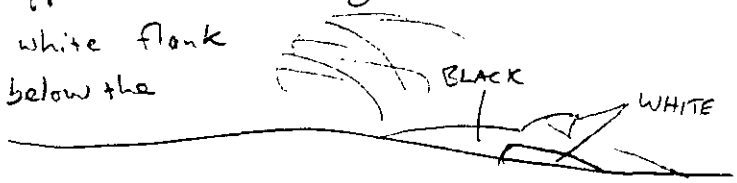
MARINE MAMMAL SIGHTING FORM – 1987
* DO NOT FILL IN BOXES PRECEDED BY AN ASTERISK

1. OBSERVER NAME JOE O. OBSERVER RECORD ID * [1 2 3 4 5 6]
   VESSEL NAME IKA MARU #7
2. DATE (Yr./Mo./Day) & TIME (local) OF SIGHTING YR [9 0] (7 8) MO [0 6] (9 10) DAY [0 2] (11 12) [1 6 1 0] (13 14 15 16)
3. LATITUDE (degrees/minutes/10ths)–N/S [3 9 4 0 .] (18 19 20 21 22) [.1] (23)
4. LONGITUDE (degrees/minutes/10ths)–E/W [1 7 1 0 6 .] (24 25 26 27 28 29) [E] (30)
5. SPECIES DALLS PORPOISE (Common name) Phocoenoides dalli dalli (Scientific name) [P D] (33 34) TENATIVE * [ ] (35)
6. NUMBER SIGHTED 7 ± 3 C.I. [2] (36) [0 0 0 7] (37 38 39 40)
7. INITIAL SIGHTING CUE ROOSTERTAIL [9 1] (45 46)
8. ANGLE FROM BOW [3 4 0] (47 48 49) 9. INITIAL SIGHTING DISTANCE 390 m
   NO. OF RETICLES 3.5
   10's of meters [0 3 9] (50 51)
10. VISIBILITY 5 miles 11. SEA STATE (Beaufort) 2 12. VIS CODE [2] (53)
13. WEATHER PARTLY CLOUDY 14. SURFACE WATER TEMP.(°C) ± [+] (54) [1 7] (55 56)
15. PLATFORM CODE [1 5 1 6] (57 58 59 60) 16. TIME ZONE ± [–] (61) [0 9] (62 63)

17. How did you identify animal(s)? Sketch and describe animal; associated organisms; behavior (include closest approach); comments.

ON EFFORT

1. Roostertail splash when surfaces.
2. Robust body, approx. 1.7 m long
3. Body Black, with white flank patch beginning below the dorsal



4. Dorsal fin low, triangular, bicolored: black & white

18. Additional information (optional) – see reverse side.

Marine Mammal Sighting Effort Forms

Fill in the same information as you do on the Marine Mammal Sighting Form, except for items 33-51. In addition, there are two other items to fill in - transit flag and observer positioning code.

TRANSIT FLAG - This is our method of recording effort. At the beginning of watch, fill in the name, vessel, date, time, position and environmental conditions, and place a 1 in box 63. When you end a watch (go below, change course more than 5 degrees, change cruising speed more than 3 knots, or if sea state visibility change), fill out the above information and place a 2 in box 63.

As marine mammals are sighted, fill out the sighting form but do not go below to get a position. Positions for all marine mammals sighted while on effort should be obtained by dead reckoning after the sighting effort is completed. You may request the radio master to calculate positions (or calculate them yourself) for all times of sightings at the end of the day, or you may leave such positions blank until you return to Seattle, whereupon you will calculate them yourself (not recommended). For all positions obtained by dead reckoning, record to nearest minute. For all positions obtained by satellite navigation systems, record to nearest 10th minute.

Transits of 20 minutes or more are of value. If continuous watch is maintained for several hours, log positions (end and begin new watch) every hour as a navigational check. Note that when a watch ends, and a new one begins immediately, the end of leg (transit flag 2) information will be the same as the beginning of the next leg information (transit flag 1). Do not maintain effort forms if your vessel is drifting or making very slow headway (e.g., oceanographic or fishing stations). Log mammals seen during these periods on the sighting forms and make note of the vessel's activity in the comments section. Do not maintain effort forms if you are not actively looking for mammals. By the same token, if you are actively looking for mammals and don't see any, fill out the effort form. It is just as important to know where the animals are not as where they are.

OBSERVER POSITIONING CODE -- This notation gives an indication of where the observer conducted the sighting work. Columns #77-80 are used for this purpose. Use columns 77 and 78 for the sighting position code and 79 and 80 for observer eye height above sea level in meters. Refer to Table 3-4.

MARINE MAMMAL SIGHTING EFFORT FORM

1	2	3	4	5	6

• Record I.D.

7	8	9	10	11	12
9	0	0	6	0	2

Year Month Day

Name JOE O. OBSERVER

Vessel IKA MARU #7

TIME					LATITUDE					N/S	LONGITUDE					E/W	SEA STATE	WEATHER	VISIBILITY	•	Vis. code	±	Sea surface	Temp. (°C)	•	Platform code		±	Time zone	Transit flag	OBSERVER Position code		
13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30				53	54	55	56	57	58	59	60	61	62	63	64	77	78	79	80
0	8	0	0		3	9	3	9	1		1	6	9	5	3	2	E	Beaf 3	CLOUDY	5 mi		3	+	1	7	1	5	1	6	-	0	9	1	4	D	0	7
0	9	0	0		3	9	3	9	3		1	7	0	0	2	8	E	Beaf 3	CLOUDY	5 mi		3	+	1	7	1	5	1	6	-	0	9	2	4	D	0	7
0	9	2	0		3	9	3	9	6		1	7	0	0	5	3	E	BEAUF 3	OVERCAST	1 mi		3	+	1	7	1	5	1	6	-	0	9	1	4	D	0	7
0	9	5	3		3	9	3	9	7		1	7	0	1	1	1	E	BEAUF 3	OVERCAST	1 mi		3	+	1	7	1	5	1	6	-	0	9	2	4	D	0	7
																			FOG																		
1	6	0	0		3	9	4	0	3	N	1	7	1	0	0	2	E	Beaf 2	PARTLY CLOUDY	5 mi		2	+	1	7	1	5	1	6	-	0	9	1	4	D	0	7
1	7	0	0		3	9	4	1	1	N	1	7	1	0	9	5	E	BEAF 2	PARTLY CLOUDY	5 mi		2	+	1	7	1	5	1	6	-	0	9	2	4	D	0	7

Table 3-2--Common and scientific names and corresponding codes for marine mammals reported by Platforms of Opportunity Program observers; names are ordered and spelled as found in MMC, Marine Mammal Names, 1976.[1] NE indicates no equivalent.

Code	Common name	Scientific Name
UM	Polar bear	Ursus maritimus
OR	Walrus	Odobenus rosmarus
ZC	California sea lion	Zalophus californianus californianus (sp)
EJ	Northern sea lion	Eumetopias jubatus
CU	Northern fur seal	Callorhinus ursinus
EL	Sea otter	Enhydra lutris
PV	Harbor seal	Phoca vitulina
PL	Spotted seal; large seal	Phoca largha
PH	Ringed seal	Phoca hispida
PF	Ribbon seal	Phoca fasciata
EB	Bearded seal	Erignathus barbatus
MA	Northern elephant seal	Mirounga angustirostris
UO	Unidentified otariid	NE
US	Unidentified phocid	NE
UP	Unidentified pinniped	NE
ER	Gray whale	Eschrichtius robustus
BA	Minke whale	Balaenoptera acutorostrata
BX	Bryde whale	Balaenoptera edeni
BB	Sei whale	Balaenoptera borealis
BP	Fin whale	Balaenoptera physalus
BL	Blue whale	Balaenoptera musculus
MN	Humpback whale	Megaptera novaeangliae
BG	Black right whale	Balaena glacialis
BM	Bowhead whale	Balaena mysticetus
SB	Rough tooth dolphin	Steno bredanensis
TT	Bottlenose dolphin	Tursiops truncatus
SL	Spinner dolphin	Stenella longirostris
SA	Spotted dolphin (C. Pacific)	Stenella attenuata
SG	Spotted dolphin (E. Pacific)	Stenella attenuata
SC	Striped dolphin	Stenella coeruleoalba
DD	Common dolphin	Delphinus delphis
LH	Frasier's dolphin	Lagenodelphis hosei
LO	Pacific whiteside dolphin	Lagenorhynchus obliquidens
LB	Northern right whale dolphin	Lissodelphis borealis
GG	Risso's dolphin	Grampus griseus
FA	Pygmy killer whale	Feresa attenuata

PC	False killer whale	Pseudorca crassidens
GM	Shortfin pilot whale	Globicephala macrorhynchus
OO	Killer whale	Orcinus orca
PP	Harbor porpoise	Phocoena
PD	Dall's porpoise	Phocoenoides dalli: dalli type
PT	Dall's porpoise	Phocoenoides dalli: truei type
PB	Dall's porpoise	Phocoenoides dalli: black type
PX	Dall's porpoise	Phocoenoides dalli: type unknown
DL	Belukha; beluga	Delphinapterus leucas
MM	Narwhal	Monodon monoceros
PM	Sperm whale	Physeter macrocephalus
BE	Baird's beaked whale	Berardius bairdii
ZX	Goosebeak whale	Ziphius cavirostris
MS	Bering Sea beaked whale	Mesoploodon stejnegeri
UD	Unidentified dolphin/porpoise	NE
UZ	Unidentified large whale	NE
UX	Unidentified small whale	NE
UW	Unidentified whale	NE

[1] Marine Mammal Commission. 1976. Marine Mammal Names. 1625 Eye Street, N.W., Washington, D.C. 20006

Table 3-3.--Explanation of surface visibility codes used in the Platforms of Opportunity Program computer format.

Code		Explanation
1	Excellent -	Surface of water calm, a high overcast solid enough to prevent sun glare. Marine Mammals will appear black against a uniform gray background. Visibility >5 km.
2	Very Good -	May be a light ripple on the surface or slightly uneven lighting but still relatively easy to distinguish animals at a distance. Visibility >5 km.
3	Good -	May be light chop, some sun glare or dark shadows in part of the survey track. Animals up close (400 meters or less) can still be detected and fairly readily identified. Visibility ≤ 5 km.
4	Fair -	Choppy waves with some slight whitecapping, sun glare or dark shadows in 50% or less of the survey track. Animals much further away than 400 meters are likely to be missed. Visibility ≤ 1 km.
5	Poor -	Wind in excess of 15 knots, waves over two feet with whitecaps, sun glare may occur in over 50% of the survey track. Animals may be missed unless within 100 meters of the survey trackline, identification difficult except with the larger species. Visibility ≤ 500 m.
6	Unacceptable -	Wind in excess of 25 knots, waves over three feet high with pronounced whitecapping. Sun glare may or may not be present. Detection of any marine mammal unlikely unless the observer is looking directly at the place where it surfaces. Identification very difficult due to improbability of seeing animal more than once. Visibility ≤ 300 m.

Table 3-4.--Observer Position Coding

In order to provide more insight into sighting efficiency, the following information will be collected on the Effort Forms and coded into columns 77-80.

Observer position (column 77)	Position
U	Upper Bridge
B	Bridge
W	Bridge Wing

Vessel code (column 78)	Vessel
D	Dedicated squid gill net
J	Squid jigging
H	Hokuten trawler and longliners

Height of observer eye above sea level in meters (columns 79-80).

3.4.2

Techniques for Shipboard Surveys of Marine Birds

by

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ABSTRACT.—We describe shipboard and small boat techniques used by the U.S. Fish and Wildlife Service in Alaska to survey marine birds at sea. The basis is a 10-min, 300-m-wide, strip transect taken from a platform moving at a constant speed in a constant direction. Special routines, such as instantaneous counts of traveling birds, are explained to help reduce biases caused by factors such as varying flight patterns, ship-following and avoidance, and patchy distributions. Data recording and coding techniques and formats, based on those developed for the National Oceanic Data Center, are described.

The collection and management of data on marine birds is of vital concern to agencies and individuals interested in coastal and marine ecosystems in Alaska. Surveys of marine birds that, by nature, spend most of their lives in pelagic habitats, are important for assessing and monitoring migratory bird populations that are affected by man's use of natural resources. The U.S. Fish and Wildlife Service, long active in population surveys, has established a survey data bank along the lines suggested by King et al. (1967) and King et al. (1974). This data bank now contains more than 8,000 h of observations from areas throughout the North Pacific Ocean and from the Beaufort, Bering, and Chukchi Seas. The impetus for the development of survey techniques, data formats, and codes, and the collection of the original data, came from the research efforts of the Outer Continental Shelf Environmental Assessment Program, funded by the Bureau of Land Management in the 1970's. The data bank has already proved useful (Hunt et al. 1981; Gould et al. 1982; Thorsteinson 1984), and will become increasingly so as it grows with future contributions. This system will enable resource managers to delineate critical habitats, monitor populations, and assess potential effects of coastal developments on marine birds.

A data bank of this magnitude is dependent on contributions from many sources, and all of the data residing in it must be comparable. We present a standardized set of techniques for surveying birds in oceanic habitats, with instructions for their use by anyone planning to contribute to this bank. With modifications, we have relied on the codes and data formats established and standardized by the National Oceanic Data Center (NODC) of the National Oceanic and Atmospheric Administration. Researchers interested in developing similar survey programs can contact NODC at their Services Division in Washington, DC, or their Alaska regional office in Anchorage, for complete and current listings. Similarly, researchers can contact the U.S. Fish and Wildlife Service, Office of Migratory Bird Management Bird Banding Laboratory, for alpha codes relating to all North American bird species.

Working conditions aboard different vessels vary considerably and can greatly affect the quantity, quality, and type of data collected. Frequently, marine bird or mammal observations are secondary to the major purpose of a cruise and the observers on board have limited ability to set itineraries such as cruise track, speed, and duration. A cruise protocol may or may not be established before leaving port and changes in ship routine may be necessary on short notice during the cruise. Not all ships are equipped to provide accurate or timely information on weather and water conditions; in some cases even accurate positions and ship speed are difficult to obtain for individual transects. The obvious consequences include small sample sizes and incomplete data sets. While this manual deals with shipboard techniques developed for Alaska, we offer it as a model for planning or conducting seabird surveys anywhere in the world. The codes and

formats that we describe can also be used for aerial surveys. The reader is refered to Savard (1979) and Forsell and Gould (1981) for techniques of aerial shoreline surveys, and to Harrison (1982) and Briggs et al. (1985) for pelagic aerial survey techniques.

Shipboard Surveys

Most shipboard investigators of marine bird populations have relied on modifications of line- or strip-transect methods and have reported their results as indexes of occurrence or abundance, supplemented with anecdotal information (e.g., Jespersen 1930; Wynne-Edwards 1935; King and Pyle 1957; Kuroda 1960; Bailey 1968; King 1970; Shuntov 1972; Gould 1974; Brown et al. 1975a, 1975b; Ainley and Jacobs 1981; Powers 1982; Blake et al. 1984). These methods, however, have differed greatly, especially in handling such problems as locating and counting a variety of species differing in behavior and conspicuousness. Among the early pioneers, Wynne-Edwards (1935) demonstrated the importance of structured observations related to unit of effort and repeated in the same area in different seasons and years. He also recognized the need for special handling of ship-following species. Wiens et al. (1978) analyzed differences in detectability as they affect measurement of densities of birds at sea, and suggested techniques that allow for greater control of specific bias-producing factors (e.g., flying birds and determining the distances at which birds are first detected). However, the effort needed to reduce the entire suite of biases inherent in transect surveys of seabirds seriously reduces the cost-effectiveness of the surveys and thus limits their usefulness. This is especially true if information in addition to abundance and distribution (e.g., behavior or age structure) is being sought. Griffiths (1981) discussed biases produced by the effect of the ship on the behavior of birds at sea. Bailey and Bourne (1972) and Tasker et. al. (1984) discussed problems involved in counting birds at sea and called for standard techniques. Bailey and Bourne (1972) stressed the need to use 10- or 15-min transects that could be analyzed separately or could be combined, depending on local density and distribution patterns. Tasker et al. (1984) reviewed the major types of at-sea survey techniques and recommended three major components of the system we describe—a 300-m-wide strip census, 10-min duration counts, and an instantaneous count of flying birds. Haney (1985) and Tasker et al. (1985) also discuss methods of counting birds at sea, with an emphasis on standardized methods.

Our survey method evolved from attempts to accumulate the maximum amount of information on the distribution and abundance of marine birds within realistic time, money, logistic, and environmental constraints (Gould et al. 1982). Of primary importance was the establishment of a standardized system that would be easy to use and teach, and that would provide consistent results in a system useful for both management (monitoring and inventory) and research programs.

We use strip census techniques to develop indexes of density (birds per square kilometer per transect). These indexes, while not being actual counts, are consistent within the data base and provide a baseline from which one may define changes in the size and distribution of seabird populations in time and space (Forsell and Gould 1981; Gould et al. 1982; Gould 1983). When conditions do not permit the use of strip transects, we suggest five supplemental techniques: skiff counts, station counts, ship-follower counts, coastline counts, and general observations. These additional methods are a part of the standardized system but are adaptable to a variety of geographic conditions.

Sampling Design for Strip Transects

Serious consideration and planning should be given to sampling design before leaving port. Once the cruise has begun, the sampling design should rarely be changed. Special sightings, such as large flocks, which cannot be predicted but are important to record, are handled by supplemental techniques (see General Observations). Situations do arise, however, that make it worth modifying the sampling design. A change in the cruise plan would require a reevaluation of sampling design to accomodate new areas. Encountering unexpected habitat features would make it worth extending a set of 3 transects into a set of 12 or more. In such a case, however, it would still be correct to code the additional transects as general observations, especially if the habitat change is small, very localized, of short duration, or not likely to reoccur. Experience in both observation and data analysis makes these decisions easier.

Pelagic Areas

There are three strategies that work well in pelagic areas, depending on the mission and schedule of the cruise. Single transects, or sets of transects, may be conducted at preset times throughout the cruise, but the observer should be consistent in the number of transects used during each observation (e.g., one per hour). Three consecutive 10-min transects every hour works well in most situations. This type of sampling is useful to

observers who have other duties during the cruise and only limited observation time.

Transects taken continuously for an extended period of time are used while a ship is moving between two points, or when conducting radials either perpendicular to a given location (such as a breeding colony) or parallel to it (along or across a habitat such as the ice edge, fronts, or continental shelfbreak). If only a single observer is available, short breaks should be inserted in the series at predetermined intervals. If two or more observers are available, they should alternate recording transect data (hourly), or one should scan the transect while the other transcribes data and occasionally relieves the first observer.

With dedicated ship time, the observer can take sets of transects within each identifiable habitat in the study area. Unfortunately, our knowledge of the oceanography of most areas is limited and it usually takes a considerable amount of sampling to identify and define oceanic habitats. Kessel (1979) has classified major habitat types for Alaska and Favorite et al. (1976) describe the marine environment of the subarctic Pacific in terms of domains and current systems. There are a few fairly reliable clues that can be used to identify habitats, such as major or rapid changes in surface water temperature, depth, or salinity. The problem of adequate sample sizes for habitats has still not been resolved for our techniques. Seabirds are frequently clumped, even within apparently homogeneous habitats, and their distribution pattern may change dramatically in a relatively short time: a density index of 1 bird per square kilometer at 0800 h in a given location may change to 1,000 birds per square kilometer in the same location at 0900 h. This is particularly true for species, that may occur in very high densities and tend to form enormous, short-term aggregations from many small, wandering flocks (e.g., the short-tailed shearwater, *Puffinus tenuirostris*). The number of transects needed to adequately form a mean density index for a given area will vary depending on the distribution of birds, the homogeneity of the habitat, and the extent of the habitat. Sample sizes should be as large as possible.

Seabirds are not uniformly or predictably active throughout the day, and different species almost certainly have different activity cycles. This variation should be recognized and allowed for by conducting surveys during as many parts of the day as possible.

Bays

Most bays and passes have varied bottom topographies, substrates, and tidal conditions. These factors affect the distribution of marine birds and their foods, and dramatic changes in abundance often occur over short distances and times. Transect paths within these habitats should sample the varied bottom topography; for example, zigzagging from shore to shore across the area. Sample as many of the habitats available to marine birds as possible, hopefully sampling each habitat in proportion to its availability to the birds. Shoreline habitats are usually undersampled when following the zig-zag pattern suggested above. When possible, adjustments should be made to the cruise tracks in order to bring the percentage of coastline sampled closer to the percentage of other habitats sampled. Timing of transect coverage is more important in bays than it is in pelagic areas; tides, for example, have a great effect on seabird activity within bays and passes.

Observation Techniques for Strip Transects

Each survey unit (e.g., 10-min counting period) is called a transect. The width and length of the transect define a rectangle; the area within the rectangle is the count zone of the transect (Fig. 1). Determining whether a bird is or is not counted depends on how a transect is defined and on the location and movement patterns of the birds. We recognize three basic types of flight patterns for this purpose: (1) feeding flight is when the bird actively

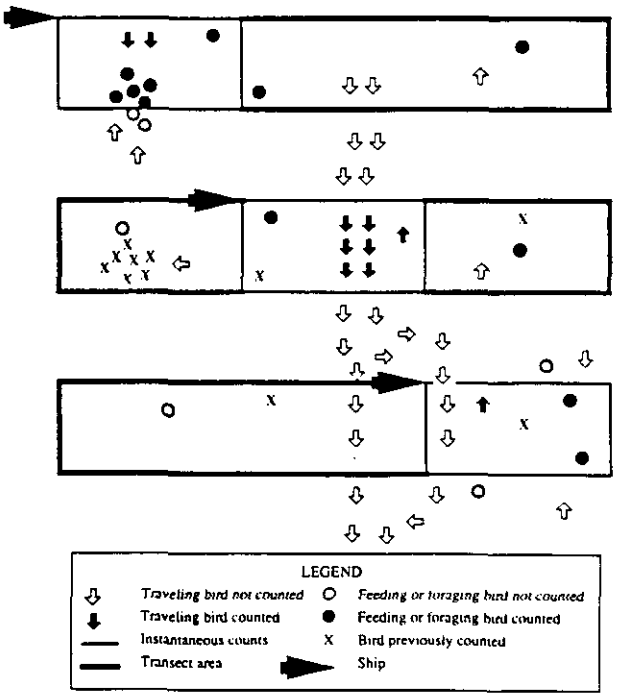

Fig. 1. Bird sightings to be included or excluded from transect, with three instantaneous counts of flying birds.

feeds, usually remaining within a relatively small area; (2) foraging flight is when the bird is moving slowly in a search pattern back and forth over the water or milling above a food source; and (3) traveling flight is when the bird is headed in a straight line, generally at a fast pace, and is not concerned with the waters immediately below it. A sighting is the observation of a single bird or group of two or more birds acting as a unit (e.g., a feeding flock).

The basic survey technique requires the ship to move along a straight path at a constant speed. For a specified length of time, an observer counts birds observed on one side of the ship out to a specified distance and forward of mid-ship until the end of the transect (Fig. 1). All feeding and foraging birds are counted whenever they are observed within the count zone. Birds in each sighting are counted only once, thus birds in a feeding flock that are outside the count zone when the flock is first sighted cannot be counted later as being within the transect. Traveling birds are counted only during periodic "instantaneous" counts (see Counting Birds).

Area Surveyed

The area surveyed during each transect varies with the ship's speed, the width of the count zone, and the duration of the observations. Different ships have different cruising speeds and unless the ship is dedicating time for bird observations, the observer will not be able to control this speed; thus, transects will have to be taken at many different speeds. The speed at which the observer moves along the transect probably influences survey results, but how it influences the number of seabird detections has never been properly studied or evaluated. At high speeds, the observer has less time available to detect and identify all birds, especially in areas of high density and areas where birds are feeding below the surface. At slow speeds, more birds may move into the counting zone and become associated with the water than at high speeds, thus inflating the count. It has been our experience that 10 kn is an average cruising speed and probably the most appropriate speed for pelagic observations. In order to hold data variability within reasonable limits we switch to supplemental techniques (e.g., general observations) at speeds of less than 6 kn and more than 15 kn.

Our standard transect width is 300 m. This width is essentially a compromise between an appropriate distance for detecting all birds under reasonable observation conditions and covering an adequate survey area with limited time and money. Detection of all birds—especially the smaller species—out to 300 m becomes difficult or even impossible when the seas are rough, or when rain, fog, or reflected sunlight reduce visibility. The height of the observer above the water also affects detection distance and a 300 m width may not be practical from a small boat except under ideal conditions.

Thus, surveys using 300-m widths are not always possible. The problem with narrower transects is that as the ship approaches some birds tend to move away from the ship, leaving the count zone and creating higher densities farther out. When most of the birds cannot be detected out to 300 m, the observer may wish to reduce the transect width to 200 m. If 200 m is too far, then only general observations should be conducted.

The ability to estimate distances is of major importance in conducting shipboard transects. Distance estimation is principally affected by the height of the observer above the water. An observer 15 m above the water often overestimates the transect width because his line of sight to the distal boundary of the survey zone is longer than that of an observer only 4 or 5 m above the water; the latter tends to underestimate because he or she perceives a foreshortened distance. Choose an observation spot as high as possible, especially on small ships. The flying bridge is usually a good choice if it is available, because it affords an ample view of the count zone. On large ships, the bridge wing may be high enough and more convenient than the flying bridge. It is rarely advisable to conduct observations from inside the pilot house.

Many techniques and kinds of equipment are available to aid in determining distances, and a primary objective of the observer when first boarding a ship should be to develop an accurate method of estimating the transect width. Most harbors are very accurately charted. Locate several objects that are known distances from the ship (e.g., 300, 500, and 1,000 m) and spend some time looking through your binoculars and getting oriented to these distances. Often you will be able to relate the distance to the sizes of birds. The relative sizes of bird species on the water is quite helpful. Practice in the harbor before leaving on the cruise will help you to use bird sizes in judging distances during a survey.

Heinemann (1981) developed a range-finder for pelagic bird censusing that can help maintain consistency in determining the border of the count zone during transects. A set of dial or slide calipers can be used as the range finder. The major limitation of this device is that the horizon must be in clear view; thus, it is not usable in bays, fog, or in rough seas. The up and down motion of the ship adds to the difficulty of using the instrument. The range-finder's accuracy is considerably reduced at heights of less than about 8 m because the angle is so slight that minor differences in the setting will greatly affect the estimate. Other considerations in using the device are

described by Heinemann (1981). Always check the range-finder during the cruise with objects whose distances can be verified by radar or other means (e.g., other ships or buoys). See Siniff et al. (1970) for another useful type of range-finder.

On small ships and where the horizon is not visible, a good technique is to trail a cylindrical buoy or other marker behind the ship so that it is 300 m behind the observer. Use floating line that will not stretch too much and has several hundred pounds breaking strength. Ship followers may congregate around this buoy enabling the observer to keep track of them as well as judge the size of birds at a known distance. If the ship's speed is known, estimates of distance can be checked by timing how long it takes to approach a floating object. When the ship is approaching floating objects such as logs, buoys, trash, or even birds, observers should estimate when the ship is an arbitrary distance (e.g., 300 m) and time how long it takes the ship to reach the object. By matching the resulting figures with those in Table 1, observers can check their estimation of distances. Be aware that currents affect the estimate depending on the relative directions of the ship and current.

Table 1. *Number of seconds*[a] *required for a ship to cover specific distances at selected speeds.*

Speed (kn)	Distance traveled (m)			
	200	300	500	1,000
6.0	64	96	160	320
6.5	59	89	148	295
7.0	55	82	137	274
7.5	51	77	128	256
8.0	48	72	120	240
8.5	45	68	113	226
9.0	43	64	107	213
9.5	40	61	101	202
10.0	38	58	96	192
10.5	37	55	91	183
11.0	35	52	87	175
11.5	33	50	83	167
12.0	32	48	80	160
12.5	31	46	77	154
13.0	30	44	74	148
13.5	28	43	71	142
14.0	27	41	69	137
14.5	26	40	66	132
15.0	26	38	64	128
15.5	25	37	62	124
16.0	24	36	60	120
16.5	23	35	58	116

[a] $\frac{1.92 \times \text{distance (m)}}{\text{speed (kn)}} = \text{seconds.}$

Duration of Observations and Length of Transects

The duration of observations not only affects the amount of area surveyed, but several other important variables, especially frequency of occurrence. Short transects cover small areas, but provide a large sample size. Long transects are less likely than short transects to miss uncommon species, thus they reduce the sometimes severe problem of accumulating many transects with no birds; many transects without sightings compound the difficulty of analyzing the data. Short transects allow observers to count bird numbers in rapidly varying habitats and have the advantage of being easier to fit into a tight schedule or into small bays and fjords, while long transects have the advantage of requiring less paper work per set of observations—not an inconsiderable problem. In the past, we have used both 10- and 15-min transects. We now use only 10-min transects. Remember that the greater the variability within or between data sets, the more difficult the data are to analyze and compare.

Counting Birds

Detecting and identifying birds at sea is a skill that has to be developed. Do not depend on your naked eyes to spot birds. Make frequent sweeps of the entire count area with your binoculars. Scanning forward to the end of the transect increases the chance to detect birds that may leave the area or dive before the ship reaches them. For birds on the water, be sure to count them as far in front of the ship as possible, since they may dive or move out of the transect zone as the ship approaches. Keep time in mind however; as the transect end approaches, the forward scanning distance becomes progressively shorter. Look over the same area more than once. Many alcids remain under water for a long time and may not be seen on the first, or even second, scan. Some birds may be located and identified by sound. In Alaskan waters, the most easily heard and recognized call is the contact note used by marbled murrelets (*Brachyramphus marmoratus*).

The objectives of the study will dictate whether emphasis will be placed on counting individuals or identifying species. In general, it is more important to detect birds and accurately enumerate them than it is to identify them. For example, it is more important to count all murres (*Uria* spp.) than to spend excessive amounts of time try-

ing to identify each bird to species. Usually enough birds are identified to species to provide a guide to interpreting unidentified birds. If birds are being missed because the observer is concentrating on identification, the observations should be coded as "general observations" and not used to develop indexes of abundance. Studies devoted to single species can make use of our techniques, but the surveys cannot be pooled with data relating to total seabirds.

Concentrate on the actual count zone and do not spend much time scanning outside of that area. Uncommon sightings and flocks observed outside of the count zone should be recorded, but they should not be actively sought, as this can result in birds being missed within the count zone itself. Perception of the transect's width narrows with distance, and it does not appear to be as wide at 1,000 m as it does at 100 m; take this into account when deciding which birds should or should not be recorded as within the transect zone. One often has to wait until a bird is directly abeam of the ship to decide if it is within the transect zone—but be cautious, for by that time the bird may have moved out of the zone in trying to avoid the ship. Record all sightings of marine mammals and of bird flocks greater than 1,000, whether they are in or out of the count zone. In the case of large flocks over large areas try to make one estimate of total flock size even if it may extend for several miles.

Theoretically, one is attempting to obtain an instantaneous count of birds within the count zone rectangle (Fig. 1). Birds that enter the count zone from behind the ship (area already surveyed) are not counted, while those that enter or leave in front of the ship are counted. There is one exception to the rule about not counting birds entering the count zone from behind the ship. If traveling birds are moving in the same direction as the ship, then those in the count zone during instantaneous counts should be recorded.

Large numbers of traveling birds present a special problem. If the observer counted all the individuals flying through the count zone, density indexes would not only be greatly exaggerated, but would reflect birds using the air corridor over the water rather than being associated with the water itself. To reduce this particular bias, we have a special method of counting traveling birds.

When there are traveling birds passing through the area each individual is not recorded. Instead, we make instantaneous counts of these birds within successive sections of the count zone (Fig. 1). The number and size of instantaneous count zones depends on the maximum distance at which all of the traveling birds can be detected and the speed of the ship. The area covered by all of the instantaneous counts added together always equals the total transect count zone. For example, during a 10-min transect at a speed of 10 kn, the ship would cover a total distance of 3,087 m (Table 2). For large flying birds, we would take three instantaneous counts each covering an area extending about 1,000 m ahead of the ship and 300 m to one side. One count would be taken at the start of the transect, one at 200 s (ca. 3.3 min) into the transect, and one at 400 s (ca. 6.7 min) into the transect. The three counts added together would be our estimate of the number of traveling birds in the entire transect at any one time. Value judgements as to distance and whether to include this or that bird become easier and more trustworthy with experience. For smaller flying birds, such as storm-petrels (Hydrobatidae), an instantaneous count zone of 300–500 m is usually more appropriate. Instantaneous counts to 300 m ahead of a ship moving at 10 kn would be taken at approximately 58-s intervals. If birds are sitting on the water or there are other indicators of position, instantaneous counts can be judged by these objects rather than by the time and speed of the ship. In summary, instantaneous counts are an attempt to obtain a single picture of traveling birds within the total count zone at any one time by putting together a series of smaller pictures.

Occasionally a judgement will be required as to whether to use instantaneous counts for a large flock of foraging birds. Normally such flocks are counted only once when first observed, but if the flock is larger than the total transect then it may be more appropriate to treat them as traveling birds and use the instantaneous count method. The distance from the observer to the end of the transect at various ship speeds can be obtained from Table 2.

A situation requiring special treatment is that of a large flock of birds being deflected in front of the ship; for example, 10,000 short-tailed shearwaters, all in one flock, streaming along the side of the ship and then across the bow. The flock is continuously passing in front of the ship because it is being deflected forward (Fig. 1). Such a flock should only be counted once (i.e., in the first instant count) and then ignored in all future counts.

Land birds and flocks of shorebirds that are obviously just passing over the area on migration or moving between two distant points are handled differently than marine birds. By using proper coding techniques (see Appendix B), these sightings can be included in the data base without influencing density indexes.

Estimating numbers is a major source of bias in surveys. Before going into the field, practice estimating large numbers of objects such as beans on a table or birds in pictures (Arbib 1972). Most field observers estimate the number of birds in large flocks by counting in 10's or 100's. This requires the observer to maintain a firm mental

Table 2. *Meters to the end of the transect per minute into transect.*

Speed made good (nmi/h)	Minutes into transect														
	00[a]	01	02	03	04	05[b]	06	07	08	09	10	11	12	13	14[c]
6.0	2,778	2,593	2,408	2,222	2,037	1,852	1,667	1,482	1,296	1,111	926	741	556	370	185
7.0	3,241	3,025	2,809	2,593	2,377	2,161	1,945	1,729	1,512	1,296	1,080	864	648	432	216
8.0	3,704	3,457	3,210	2,962	2,716	2,469	2,222	1,975	1,729	1,482	1,285	988	741	494	247
9.0	4,167	3,889	3,611	3,334	3,056	2,778	2,500	2,222	1,945	1,667	1,389	1,111	833	566	278
10.0	4,630	4,321	4,013	3,704	3,395	3,087	2,778	2,469	2,161	1,852	1,543	1,235	926	617	309
11.0	5,093	4,753	4,414	4,074	3,735	3,395	3,056	2,716	2,377	2,037	1,698	1,358	1,019	679	340
12.0	5,556	5,186	4,815	4,445	4,074	3,704	3,334	2,963	2,593	2,222	1,652	1,482	1,111	741	370
13.0	6,019	5,618	5,216	4,815	4,414	4,013	3,611	3,210	2,609	2,408	2,006	1,605	1,204	803	401
14.0	6,482	6,050	5,618	5,186	4,753	4,321	3,889	3,457	3,025	2,593	2,161	1,729	1,296	864	432
15.0	6,945	6,482	6,019	5,556	5,093	4,630	4,167	3,704	3,241	2,776	2,315	1,852	1,389	906	463
16.0	7,408	6,914	6,420	5,926	5,432	4,939	4,445	3,951	3,457	2,963	2,469	1,975	1,482	988	494

[a] Meters traveled in 15 min (= start of 15-min transect).
[b] Meters traveled in 10 min (= start of 10-min transect).
[c] Meters traveled in 1 min.

1 nautical mile = 1,852 meters = 6076.12 feet.

picture of 10 or 100 birds. Distant flocks usually appear to have fewer birds than is actually the case because many will be hidden by other birds or by waves and swells; some birds in feeding flocks may even be sitting on the water or diving beneath it. Distant vision at sea may also be impaired by atmospheric conditions such as rising heat and mist, which tend to obscure birds. Do not become overwhelmed with large numbers of birds; continue to count numbers of birds rather than to make guesses.

Support Data

Before departure, observers should learn as much as possible about the activities and protocol of the ship. They should meet with the appropriate officers and crew to explain what research will be conducted and what help will be needed. Techniques should be explained, stressing the importance of the ship maintaining a constant speed and course during observation periods. Plan your observation periods ahead of time and try to stick to the plan. Let the officers and crew know when you will be making observations and have them inform you about projected maneuvers and course changes. You can leave a standing call to be notified when large concentrations of birds are encountered, but use these times for general observations rather than transects. It is important that you conduct transects throughout the survey in accordance with your regular schedule. Do not add or delete transects just because you encounter exceptionally high or low bird densities. In planning your schedule do not try to cram as many observations into a day as possible. Remember that you have lots of paper work to do for each transect you take, and that you see fewer birds when you are tired. It is preferable to collect a few data of high quality than many data of only moderate quality. The NODC defined many support fields that we have elected not to use because the time and effort needed to record, transpose, and analyze them would prevent accomplishment of our primary goals. The two most important pieces of supporting data that must be obtained for each transect are the correct position and the speed made good.

Position

Do not simply accept positions given by bridge personnel, especially if they are being read from a LORAN C or satellite navigation system—these systems can be inaccurate and may vary from minute to minute. If land can be detected on radar, it is best to get a position by measuring the distance from at least two, and preferably three, distinct landforms; the correct position is where the arcs of the distances cross each other. Try to plot the position on a nautical chart immediately to be sure there are no errors, and record the depth from the chart. If the position matches an electronic system such as a LORAN C interpolator, it can be assumed that the electronic system is correct and positions can be taken from it for the next hour or two. The position should be checked at least every 2 h. If the ship is too far from land to obtain good distance

readings from a radar, or only one distance is available, the position from the LORAN C can be checked by a combination of depths, LORAN C lines, and bearings to a land mass.

To interpolate between two good positions, divide the speed in knots by 60 and multiply by the minutes duration of the transect. This gives you the distance traveled on each transect. This distance can then be stepped off with dividers between the beginning and ending positions, and each new position can then be read from the chart. The positions should always be calculated as soon as possible after the observations. When obtaining positions from a chart, the depth should also be taken and compared with the depth obtained from the ship's equipment. If the ship's crew are not plotting positions on a nautical chart at least every 2 h, do so yourself, and be sure a position is taken at every course change. Check all of your positions for a logical and consistent progression. Write all the particulars of the fix in the field notes on the data form.

Speed

The speed made good can be calculated by obtaining two accurate positions (preferably at least a couple hours apart) and measuring the distance between the two points with a pair of dividers. Move to the left or right edge of the chart at the same latitude (the scale varies with latitude on a mercator projection) and measure the nautical miles on the latitude scale. One nautical mile is equal to 1 min of latitude, and 1° of latitude is equal to 60 nmi. The speed made good is obtained by dividing the nautical miles traveled by the elapsed time (expressed in tenths of hours). The speed made good is the distance traveled over the ocean floor. Due to tides, or the action of currents, the speed made good may be different from the speed through the water. In most cases, the difference between the two speeds is negligible, but in some passes, water may flow at a rate of several knots. Birds are usually associated with the water column, thus moving with it, and speed through the water may give a more accurate representation of bird density than speed over the bottom. Many research ships are now equipped with water speed indicators, and in areas of fast moving currents the speed through the water should be used. Speed is always taken in nautical miles per hour (knots). One knot is equal to 1.15 statute mi/h or 1.852 km/h.

Depth

Depths can be read directly from a fathometer by yourself or by a crew member. If positions are accurate and navigation charts of sufficient scale are available, depths can be determined directly. However, it is always best to use the fathometer. We often record the depths in fathoms below the field on the transect form and convert it to meters at a later time (1.83 m = 1 fathom).

Temperature and Salinity

Sea-surface temperature and salinity are obtained in various ways. The ideal method is a continuously recording thermo-salinograph, which records both temperature and salinity on graph paper. Most ships measure sea temperature at the water intake for cooling their engines. This is often a couple of meters below the surface, but mixing is generally sufficient to get reasonable readings. Large ships usually record this temperature each hour. Unfortunately, the reading may be done by different persons during each day and often little care is taken when reading the thermometer. Ask to see where the temperature gauge is located and impress on the engine room personnel the importance of consistent and accurate readings. The best method is to check the temperatures yourself at the beginning and end of each series of transects. Both water temperature and salinity can be measured with inexpensive hand-held devices using water samples freshly collected in a bucket over the side of the ship. Take the sample on the side of the ship opposite the outlet for hot water from the engines. Occasional bucket temperatures should be taken to check on the more frequently obtained intake temperatures. Depth, temperature, salinity, and other environmental data are best taken at the mid-point of each transect, but it is often more convenient to obtain them at the beginning. In either case, be consistent throughout the survey.

Ice

The presence of ice is an environmental variable that affects the density and distribution of birds at sea. Coverage and pattern are the most important features of ice both inside and outside of the count zone. The distance to the ice edge is also important, especially out to 20 mi, and should be recorded whenever possible.

Miscellaneous

Seabirds may react to meteorological events (Manikowski 1971) and we record barometric pressure, weather, and wind speed for each transect. Sea state, swell height, and tide are low priority items and are not recorded when time is scarce.

Survey Procedures

Make sure all necessary environmental data (e.g., depth and temperature) and locational data (e.g., positions and speed) will be available and that the bridge personnel know that you are beginning observations. Select the best point on the ship from which you can obtain an unobstructed view of the potential count zone. Set your watch to match your time with that of the ship. Obtain from the bridge the ship's approximate speed and direction. Determine how many instantaneous counts you will need to fill up the transect. Recording begins with all environmental data, such as barometric pressure and sea state, and a determination of the observation conditions. Spend several minutes studying the birds in the immediate vicinity of the ship, noting the general behavior of all birds within the area, and then record the maximum number of each ship-following species on the transect form. Bow-riding porpoises are handled the same as ship followers. Begin the transect by making the first instantaneous count.

Supplemental Techniques

Skiff Counts

Transects can be conducted from skiffs. All birds are counted within a specified distance on both sides of the skiff; 50–75 m on each side is a fairly standard distance if the observer is sitting, and 75–100 m if standing. The area covered by the survey is determined by the distance between a starting and ending position, rather than by speed and time. To obtain accurate positions it is best to conduct transects between known points of land or buoys. Linear distance (in hundreds of meters) should be placed in columns 76–78 of the coding form (Fig. 2).

Coastline Counts

Coastline surveys are best conducted from platforms such as skiffs or small ships. The observer should stay as far offshore as possible, while still being able to detect and identify all birds on the water and roosting on shore. All birds between the shore and the platform and from the platform to the limit of visibility on the other side of the platform are counted. On this type of survey, birds on shore can be included by recording them with a "4" in the Zone column. Usually the width of the count area is about 75 m on each side, but it varies with visibility and water conditions. Density estimates are impossible to construct, and the unit of analysis is birds per kilometer of coastline. We recommend using distinct headlands as the divisions between counts so counts can be readily repeated.

Ship-follower Counts

The only time a ship-following bird is coded as being in a transect is when it joins the ship for the first time (i.e., before it becomes a ship-follower). Otherwise, ship-following birds are not included in density indexes. It is worthwhile, however, to keep a continuous record of their numbers, especially when individual birds cannot be separated. On every transect the observer records the largest number of each ship-following species seen at any one time. Ship-follower counts add to the observer's awareness of what birds are in the area and how the birds are reacting to the ship. In addition, they help an observer determine whether to count birds approaching the ship and whether a sighting represents a new bird or one counted previously.

Station Counts

These counts are taken from a fixed point, usually from a ship stopped for oceanographic sampling or fishing. These counts are valuable for determining the numbers of birds that may be dependent on fishing vessels or are vulnerable to pollution from ships. They also provide an excellent opportunity to obtain ratios (e.g., color phases, age, sex, species). The survey area is generally a circle with a 300–600 m radius and the observer at the center. All birds are counted within the count zone by making a circular sweep of the entire area as rapidly as is consistent with accurate detection and counting of birds within the area. Only one sweep is made per survey. The length of time the ship has been stationary should be recorded for each survey, because numbers of birds usually continue to increase for a long period after the ship has stopped. The best place to record this information, along with pertinent information on the ship's activity, is in the Field Notes section of the data sheet. Whenever possible, these counts should be repeated every 30 or 60 min.

General Observations

Important incidental observations should be recorded and are maintained within the data base. Of particular importance are the location of feeding flocks, large assemblages, and rare species that would not otherwise be recorded. General observations are used: when transects terminate before the designated time; when the ship makes large-scale changes in course or speed during the

HEADER

FILE TYPE	FILE IDENTIFIER						
1 2 3	4 5 6	7	8	9			
0 3 3	F 8 5	1	0	0			

STAT NO		STAT TYPE	
11 12 13		14 15	
2 7		6 9	

U.S. FISH & WILDLIFE SERVICE
PELAGIC SEABIRD PROJECT

PAGE 157
OBSERVER('S) Gould
TRANSCRIBER Forsell

LOCATION

RT	START LAT				START LONG				DATE - TIME					END LAT				END LONG				ELAP TIME	± TIME ZONE	SPEED KNOTS	COURSE	HT. METERS	SUB	REGION	DIST KM	OC	HAB 1	HAB 2	TRANS WIDTH 10'S	TRANS WIDTH HM
	DEG	MIN	S	H	DEG	MIN	S	H	YR	MON	DAY	HR	MIN	DEG	MIN	S	H	DEG	MIN	S	H	TIME	ZONE	KNOTS	RSE	METERS	B	ION	KM	C	1	2	10'S	HM
10	16 17 18 19	20	22		23 24 25	26 27	28	30	31 32	33 34	35 36	37 38	39 40	41 42	43 44	45	47	48 49	50 51	52 53	55	56 57	58 59	60	61 62	63 64	65 66	67 68	69	70 71	72 73	74 75	76	77 78	79	80
1	5 2 2 7	5	N		1 7 3	2 9	0	W	8 5	1 0	2 4	1 8	0 0									1 0	+	1 1		1 0	2 7			8		2 2		5			3	0

ENVIRONMENT

RT	DEPTH METERS				±	SURFACE WATER TEMP		SURFACE WATER SAL				DIST TO LAND NM			ICE	BAROMETRIC PRESSURE MB					i	WIND KN		SEA	SWELL HT M			WEATHER		ICE IN TRANS C	T	F	R	TH	M	OUT C	T	TIDE
10	16 17 18 19				23	24 25 26		27 28 29				31	32 33 34		35	39	40 41 42		43	44		47	48	49	52	53	54	55	56	59	60	61	62	63	64	65	66	69
2		7	8	5	+	9	5	3	2	0			1 8	7		1	0 0	6	2	+		1	1	2		1	5		0	3									

DATA

RT	COMMON NAME	TAXONOMIC CODE	AGE	SEX	CP	GROUP SIZE	NUMBER	FLT DIR	LNK	BEHAVIOR	OZ	HAB	SEQ
10	63 64 65 66	18 19 20 21 22 23 24 25 26 27	32	33	34		37 38 39 40 41	48 49	53	56 57	60	76 77	79 80
5	COMU					1, 2, 4, 6	13			01	0		1
5	BLKI					1	1	24		20	0		2
5	STSH					50, 20, 18	88			01	0		3
5	STSH					1000	1000			01	2		4
5	TUPU					13	13		1	70	0		5
5	BLKI					18	18		1	71	0		6
5	COMU					4	4		1	70	0		7
5	NOFU				6	1, 1, 10	12			29	0		8
5	COMU		P			1	1		2	01	0		9
5	COMU		A		0	1	1		2	01	0		0
5	WAAL					1	1			29	0		11
5	STSH					150550	99999		1	35	2		12
5	STSH						50001		1	35	2		13
5	STSH						55 0		1	35	0		14

FIELD NOTES

Loran C 16010
49571

Sequam Isl. 32.2 NM

Cape Shaw-
Atka Isl. 20 NM

Cape Idaluq-
Amlia Isl. 18.7 NM

Feeding Flock

Young bird 3/4 size of adult

Sighting questionable

Fig. 2. Annotated coding form for marine bird surveys.

transect; when other reasons invalidate the use of the observations to develop density indexes; between standard transects; or in areas and times where transects were not planned.

Record Keeping

Data collected during pelagic surveys are transcribed onto coding forms (Fig. 2) using information fields (Appendix A), and special codes (Appendix B). Data are then entered into the computer from the coding forms. These forms are usually filled in at the time of the observation, directly from binoculars to coding form (always if a second observer or helper is available). If it is impossible to record directly onto the form (e.g., because of high bird numbers), then tape recorders or waterproof notebooks can be used, but data should be transferred to the coding forms as soon as possible. The disadvantages of a tape recorder or notebook are in the time needed to transcribe information from one place to another, and in adding another step where transcription errors can occur. Transcription errors are a major problem in automating data. The tape recorder must also be checked frequently to be sure that it is not malfunctioning. As with the direct entry method, use of a notebook also distracts the observer's attention from the count zone. All marine mammal sightings inside and outside the transect zone are recorded using the same format as bird sightings, except that the codes for Behavior are different. Coding forms constitute our major field record, and as such should be filled out meticulously in pencil, double checked for accuracy, and kept clean and in a safe place. Any pertinent observations that cannot be coded should be printed clearly in the space provided under Field Notes. This should include documentation of all rare or unusual sightings. Figure 2 gives examples of proper entry of raw data onto the coding form.

Do not enter numbers into any field when the information is unknown or in doubt unless there is a specific code for unknown or doubtful. Zeros represent actual data. When a field (e.g., Station, Transect Width, Number of Birds) is used, zeros should not be placed in the columns to the left of the first significant number or letter entered (i.e., fill in zeros to the right but not to the left). For example, in the Station Number field, transect number 1 should be entered as "--1", transect 10 as "-10", and transect 100 as "100". If there are no birds observed within the count zone then the form is filled out with NONE or BIRD for the alpha identification code, a "0" in the Number column, and a "0" in the Zone column. Our data-entry program will automatically generate the taxonomic code when the proper species alpha code (Appendix C) is entered. It is thus necessary to enter the taxonomic code on the data sheet only if an alpha code is not listed.

We have developed analyses programs that require certain coding fields to be entered. These fields are listed and explained in Appendix A. It is of vital importance that observers read Appendix A carefully in order to understand coding techniques. The codes, coding forms, and placement of many of the fields were originally developed by researchers in the Outer Contentinal Shelf Environmental Assessment Program. We have tried to keep our format as similar as possible to the NODC file type "033" format and codes.

Acknowledgments

The basis for all pelagic surveys of marine birds was established many years ago by the pioneering efforts of W. R. P. Bourne, H. B. Moore, R. C. Murphy, V. C. Wynne-Edwards, and many other biologists and laymen. We began in early 1975 on the project in Alaska as conceived and defined by J. C. Bartonek and C. J. Lensink. The project evolved and refinements have been made up to the present time by many people. To all who helped: Thank you.

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References

Ainley, D. G., and S. S. Jacobs. 1981. Sea-bird affinities for ocean and ice boundaries in the Antarctic. Deep-Sea Res. 28A:1173-1185.

Arbib, R. 1972. On the art of estimating numbers. Am. Birds 26:706-712, 814.

Bailey, R. S. 1968. The pelagic distribution of sea-birds in the western Indian Ocean. Ibis 110:493-519.

Bailey, R. S., and W. R. P. Bourne. 1972. Notes on sea-birds, 36: counting birds at sea. Ardea 60:124-127.

Blake, B. F., M. L. Tasker, P. Hope Jones, T. J. Dixon, R. Mitchell, and D. R. Langslow. 1984. Seabird distribution in the North Sea. Nature Conservancy Council, Huntingdon, England.

Briggs, K. T., W. B. Tyler, and D. B. Lewis. 1985. Aerial surveys for seabirds: methodological experiments. J. Wildl. Manage. 49:412–417.

Brown, R. G. B., F. Cooke, P. K. Kinnear, and E. L. Mills. 1975a. Summer seabird distributions in Drake Passage, the Chilean Fjords and off southern South America. Ibis 117:339–356.

Brown, R. G. B., D. N. Nettleship, P. Germain, C. E. Tull, and T. Davis. 1975b. Atlas of eastern Canadian seabirds. Canadian Wildlife Service, Ottawa. 220 pp.

Favorite, F., A. J. Dodimead, and K. Nasu. 1976. Oceanography of the subarctic Pacific region, 1960–1971. Bull. Int. North Pac. Fish. Comm. 33. 187 pp.

Forsell, D. J., and P. J. Gould. 1981. Distribution and abundance of marine birds and mammals wintering in the Kodiak area of Alaska. U.S. Fish Wildl. Serv., FWS/OBS-81/13. 72 pp.

Gould, P. J. 1974. Introduction. Pages 1–5 *in* W. B. King, ed. Pelagic studies of seabirds in the central and eastern Pacific Ocean. Smithson. Contrib. Zool. 158.

Gould, P. J. 1983. Seabirds between Alaska and Hawaii. Condor 85:286–291.

Gould, P. J., D. J. Forsell, and C. J. Lensink. 1982. Pelagic distribution and abundance of seabirds in the Gulf of Alaska and eastern Bering Sea. U.S. Fish Wildl. Serv., FWS/OBS-82/48. 294 pp.

Griffiths, A. M. 1981. Biases in censuses of pelagic seabirds in the southern ocean. Pages 189–196 *in* J. Cooper, ed. Proceedings of the symposium on birds of the sea and shore held at the University of Cape Town, Cape Town, South Africa, 19–21 November 1979. African Seabird Group, Cape Town.

Haney, J. C. 1985. Counting seabirds at sea from ships: comments on interstudy comparisons and methodological standardization. Auk 102:897–898.

Harrison, C. S. 1982. Spring distribution and abundance of marine birds in the Gulf of Alaska. Condor 84:245–254.

Heinemann, D. 1981. A range finder for pelagic bird censusing. J. Wildl. Manage. 42:489–493.

Hunt, G. L., Jr., P. J. Gould, D. J. Forsell, and H. Petersen, Jr. 1981. Pelagic distribution of marine birds in the eastern Bering Sea. Pages 689–718 *in* D. W. Hood and J. A. Calder, eds. The eastern Bering Sea shelf: oceanography and resources. National Oceanic and Atmospheric Administration, Office of Marine Pollution Assessment, Seattle, Wash.

Jespersen, P. 1930. Ornithological observations in the north Atlantic Ocean. The Danish "Dana" expeditions 1920–22 in the North Atlantic and the Gulf of Panama. Oceanographical reports edited by the "Dana" Committee No. 7, Copenhagen, Denmark..

Kessel, B. 1979. Avian habitat classification for Alaska. Murrelet 60:86–94.

King, J. E., and R. L. Pyle. 1957. Observations on sea birds in the tropical Pacific. Condor 59:27–39.

King, J. G., G. E. Marshal, J. H. Branson, F. H. Fay, and W. Allen. 1974. Alaskan pelagic bird observations and a data bank proposal. Unpubl. rep., U.S. Fish Wildlife Service, Juneau, Alaska.

King, W. B. 1970. The trade wind zone oceanography pilot study Part VII: observations of sea birds March 1964 to June 1965. U.S. Fish Wildl. Serv., Spec. Sci. Rep. Fish. 586.

King, W. B., G. E. Watson, and P. J. Gould. 1967. An application of automatic data processing to the study of seabirds, I: numerical coding. Proc. U.S. Natl. Mus. 123(3609):1–29.

Kuroda, N. 1960. Analysis of sea bird distribution in the northwest Pacific Ocean. Pac. Sci. 14:55–67.

Manikowski, S. 1971. The influence of meteorological factors on the behavior of sea birds. Acta Zool. Cracov. XVI:582–673.

Powers, K. D. 1982. A comparison of two methods of counting birds at sea. J. Field Ornithol. 53:209–222.

Savard, J. L. 1979. Marine birds of Dixon Entrance Hecate Strait and Chatham Sound, B.C., during fall 1977 and winter 1978. Canadian Wildlife Service, Ottawa. 104 pp.

Shuntov, V. P. 1972. Marine birds and the biological structure of the ocean. Pac. Res. Instit. Manage. Oceanogr. (TINRO), Far-Eastern Publishers, Vladivostok, USSR.

Siniff, D. B., D. R. Cline, and A. W. Erickson. 1970. Population densities of seals in the Weddell Sea, Antarctica, in 1968. Antarct. Ecol. 1:377–394.

Tasker, M. L., P. Hope Jones, B. F. Blake, and T. J. Dixon. 1985. Response to J. C. Haney. Auk 102:899–900.

Tasker, M. L., P. Hope Jones, T. Dixon, and B. F. Blake. 1984. Counting seabirds at sea from ships: a review of methods employed and a suggestion for a standardized approach. Auk 101:567–577.

Thorsteinson, L., editor. 1984. Proceedings of a synthesis meeting: the north Aleutian shelf environment and possible consequences of planned offshore oil and gas development, Anchorage, Alaska, 9–11 March 1982. National Oceanic and Atmospheric Association, Office of Marine Pollution Assessment, Juneau, Alaska.

Wiens, J. A., D. Heinemann, and W. Hoffman. 1978. Community structure, distribution and interrelationships of marine birds in the Gulf of Alaska. Pages 1–178 *in* Environmental assessment of the Alaskan continental shelf. Final reports of principal investigators. Vol. 3. National Oceanic and Atmospheric Association, Environmental Research Laboratory, Boulder, Colo.

Wynne-Edwards, V. C. 1935. On the habits and distribution of birds on the North Atlantic. Proc. Boston Soc. Nat. Hist. 40:233–346.

Appendix A. Explanation and Format of Information Fields for Digital Data

Header Card

File Type (1–3) Always 033. Identifies marine bird transects within the NODC data base.

Field Operation Number (4–9) This number identifies an individual field operation. Numbers are managed by the U.S. Fish and Wildlife Service, Region 7.

Station Number (11–13) A sequential number (001–999) for each transect or station within a field operation; this number cannot be duplicated during any one operation.

Station Type (14–15) Codes 1 and 2 (Appendix B). Column 14 indicates the type of platform, and column 15 indicates the type of survey.

Record Type (10) Distinguishes information pertaining to location (always 1), environment and ice conditions (always 2), and census data (always 5).

Record Type 1: Location Data

Start Latitude (16–22) and Start Longitude (23–30) Position of platform at the start of observations in degrees (DEG), minutes (MIN), seconds (S), and hemisphere (H). Seconds recorded in tens of seconds. Alpha codes (N, S, E, and W) are used for hemisphere.

Date (31–36) and Time (37–40) Year, month, day, and time at start of observations (use local time and a 24-h clock).

End Latitude (41–47) and End Longitude (48–55) Position of platform at end of observations in degrees (DEG), minutes (MIN), seconds (S), and hemisphere (H). Seconds recorded in tens of seconds. Alpha codes (N, S, E, and W) are used for hemisphere. This field is required for aerial surveys, coastline counts, skiff counts, and observations that last 30 min or longer.

Elapsed Time (56–57) Length of survey, in minutes. A value of 99 indicates an elapsed time equal to or greater than 99 min.

Time Zone (58–60) Time zone of time entered on transect form relative to Greenwich Mean Time. Column 58 is a "+" or "−".

Speed (61–63) Platform speed made good, in whole knots.

Course (64–65) Platform course made good, in tens of degrees (based on true north).

Height (66–68) *Height of observer's eye above water, in meters.*

Substrate (69) Codes assigned by the observer for a specific project. This code has been used only in shoreline surveys up to this time. Codes from 0 to 9 can be assigned and any set of numbers chosen for analysis.

Region or Survey Area (70–71) Codes assigned by the observer for a specific cruise or project. Regions from 00 to 99 can be assigned and any set of numbers chosen for analysis.

Distance (72–74) Distance traveled between start and end of transect, to the nearest tenth of a kilometer. This field must be completed for coastline surveys and transects conducted from skiffs where speeds may vary. This field may be completed for transects where area calculations of greater precision are needed than will be obtained from speed in whole knots, or where transects are of a fixed distance regardless of time or speed.

Observation Conditions (75) See code 3, Appendix B. A subjective evaluation of observation conditions, on a scale from 1 to 7, with 7 being ideal. Observation conditions take into account all factors that may affect the ability of the observer to detect all of the birds in the count zone, including sea state, visibility, wind, light, observer's position on the ship, quality of binoculars, and the condition and attentiveness of the observer. An observation condition of 7 would mean all birds, even at 300 m, are probably detected and identified. Under conditions of 1 or 2, enough birds are missed that we do not use the observations for density estimates, but occurrence and large flocks are still important.

Habitat I (76) Codes assigned by the observer for a specific cruise or project. Codes from 0 to 9 can be assigned and any combination of numbers chosen for analysis.

Habitat II (77) Codes assigned by the observer for a specific cruise or project. Codes from 0 to 9 can be assigned and any combination of numbers chosen for analysis.

Transect Width (78–80) Width of count zone in tens of meters (e.g., 300 m zone is recorded as "30").

Record Type 2: Environmental Data

Depth (16–19) Depth of water column, in whole meters. If the transect begins or ends at shore enter 1 m. One fathom is equal to 1.83 m.

Surface Temperature (23–26) Surface temperature of water to nearest tenth of a degree Celsius. Column 23 indicates positive or negative degrees (if left blank positive values are assumed).

Surface Salinity (27–29) Surface salinity, to nearest tenth of a part per thousand.

Distance to Land (31–34) Distance to nearest land, in tenths of a nautical mile.

Distance to Ice Edge (35) See code 4, Appendix B. Distance to nearest ice edge, in nautical miles.

Barometric Pressure (39–44) Barometric pressure, to nearest tenth of a millibar. Column 44 uses + for rising, 0 for steady, and − for falling.

Wind Speed (47–48) Speed of wind, in knots.

Sea State (49) See code 5, Appendix B.

Swell (52–54) Height, in tenths of meters.

Weather (55–56) See code 6, Appendix B.

Ice in Transect (59–64) and Ice out of Transect (65–66)

Coverage (59 and 65): See code 7, Appendix B.
Type (60 and 66): See code 8, Appendix B.
Form (61): See code 9, Appendix B.
Relief (62): See code 10, Appendix B.
Thickness (63): See code 11, Appendix B.
Stage of Melt (64): See code 12, Appendix B.

Tide (69) See code 13, Appendix B.

Record Type 5: Observation Data

Common Name (——) See Appendix C. These alpha codes are entered during the transect. The taxonomic code (18–29) is inserted by the computer from these codes; thus it is important to use the alpha codes listed in Appendix C. Generally, we use the first two letters of each common name (e.g., common murre = COMU). If one of the names is hyphenated we use the first letter of each name (e.g., red-legged kittiwake = RLKI). UN is used for unknowns (e.g., unidentified gull = UNGU, unidentified large alcid = UNLA).

Taxonomic Code (18–29) It is not necessary to complete these columns if the proper alpha code is used. We use the NODC codes, which are based on five taxonomic groupings, each with two digits. For example, a common murre is represented by 9129010301 where 91 = class (Aves); 29 = order or suborder (Charadriiformes); 01 = family (Alcidae); 03 = genus (*Uria*); and 01 = species epithet (*aalge*). This code system enables us to analyze our data at various taxonomic levels.

Age (32) See code 14, Appendix B.

Sex (33) See code 15, Appendix B.

Color Phase or Plumage (34) See code 16, Appendix B.

Group Size This area of the form is used for accumulating individual sightings of a particular species with the same behaviors, flight directions, sex, age, color phase, and plumage attributes. The total number is then put in the Number field (37–41). Each sighting may be used for noncomputer analysis of group sizes. Therefore, each individual or group acting as a unit should be entered as a separate number in Group Size. This field is especially helpful when recording data directly on the data forms.

Number (37–41) Number of birds recorded within the parameters defined by Transect Width and Zone columns.

Flight Direction (48–49) Direction of bird's flight in tens of degrees based on true north (i.e., 240° = 24, 80° = 08, 8° = 01, 3° = 00).

Linkage (53) These columns are used to unite two or more records into a single sighting or to link two or more related sightings. For example, if 150,000 birds were observed in one flock then two cards each of 75,000 would be needed. Each of these cards would have "1" in the Linkage column (Fig. 2). Another example would be if a feeding flock of more than one species were observed, all of the species sighted would be linked with a common number. Successive associations that occur on one transect are consecutively numbered.

Behavior (56–57) See codes 17 and 18, Appendix B.

Zone (60) See code 18, Appendix B. This field increases the versatility of the transect form by allowing us to record other significant observations such as large flocks, rare birds, feeding associations, dead birds, and ship followers into the data base. For example, if a flock is partially within the transect, those birds within the count zone are recorded with a "0" in the Zone column while the rest would be recorded with a "2" in the Zone column (Fig. 2). Incidently, the sightings would be linked with a common number in the linkage column. A "0" must be recorded for all sightings to be used for calculating density indexes.

Sequence Number (78–80) These numbers make each record unique and are entered by the computer.

Appendix B. Codes for Digital Data

Code 1. Platform Type (14)

1 = Centerview aircraft (e.g., P2V, Partanavi)
2 = Twin engine sideview aircraft (Goose or Otter)
3 = Single-engine aircraft
4 = Helicopter
5 = Fixed at-sea platform
6 = Ship greater than 100 ft
7 = Ship less than 100 ft
8 = Small boat with outboard motor
9 = Other (on foot)

Code 2. Survey Type (15)

1 = General observations:	These are records of large flocks, rare or unusual sightings, transects that cannot be used to derive density indexes, or any record that will not fit another format.
2 = Inland waterway count:	These surveys are conducted in lakes, lagoons, or rivers.
3 = Bay or fjord transect:	The criteria for a transect are a visibility of at least 1,000 m and a moving platform with a constant speed and direction. A bay or fjord transect is one made within well-defined headlands.
4 = Coastline count:	A transect conducted within 100 m of the shore and following the contour of the shoreline, rather than a straight line.
5 = Ship-follower count:	A count of only ship-followers.
7 = Station count:	The criteria for a station count are that the platform is stationary and that all birds are counted in a 360° circle from the platform.
9 = Oceanic transect:	The criteria for a transect are a visibility of at least 1,000 m and a moving platform with a constant speed and direction. An oceanic-transect is conducted outside well-defined headlands.

Code 3. Observation Conditions (75)

1 = Bad (general observations only)
2 = Poor (no quantitative analysis)
3 = Fair
4 = Average
5 = Good
6 = Excellent
7 = Maximum

Code 4. Distance to Ice Edge (35)

0 = Up to 1 nmi
1 = 1.1–2.0 nmi
2 = 2.1–4.0 nmi
3 = 4.1–6.0 nmi
4 = 6.1–8.0 nmi
5 = 8.1–12.0 nmi
6 = 12.1–16.0 nmi
7 = 16.1–20.0 nmi
8 = greater than 20 nmi

Code 5. Sea State (49)

0 = Calm
1 = Rippled (0.01–0.25 ft)
2 = Wavelet (0.26–2.0 ft)
3 = Slight (2–4 ft)
4 = Moderate (4–8 ft)
5 = Rough (8–13 ft)
6 = Very rough (13–20 ft)
7 = High (20–30 ft)
8 = Over 30 ft

Code 6. Weather (55–56)

00 = Clear to partly cloudy (0–50% cloud cover)
03 = Cloudy to overcast (51–100% cloud cover)
41 = Fog (patchy)
43 = Fog (solid)
68 = Rain
71 = Snow
87 = Hail

Code 7. Ice Coverage (59 and 67)

0 = less than 1 octa (1 octa = 1/8)
1 = 1 octa
2 = 2 octas
3 = 3 octas
4 = 4 octas
5 = 5 octas
6 = 6 octas
7 = 7 octas
8 = 8 octas (with openings)
9 = 8 octas (no openings)

Code 8. Ice Type (60 and 68)

1 = New ice
2 = Fast ice
3 = Pack or drift ice
4 = Packed slush or sludge
5 = Shore ice
6 = Heavy fast ice
7 = Heavy pack or drift ice
8 = Hummocked ice
9 = Icebergs

Code 9. Ice Form (61)

1 = Ice of land origin
2 = Pancake ice
3 = Brash ice or ice cakes
4 = Small ice floes (car-sized)
5 = Medium ice floes (house-sized)
6 = Large ice floes (acre-sized)
7 = Vast ice floes (football-field-sized)
8 = Giant ice floes
9 = Fast ice

Code 10. Ice Relief (62)

0 = Level ice
1 = Rafted ice
2 = Finger-rafted ice
3 = Hummocks
4 = New ridges
5 = Weathered ridges
6 = Very weathered ridges
7 = Aged ridges
8 = Consolidated ridges
9 = Standing flow

Code 11. Ice Thickness (63)

0 = less than 5 cm
1 = 5–9 cm
2 = 10–19 cm
3 = 20–29 cm
4 = 30–39 cm
5 = 40–59 cm
6 = 60–89 cm
7 = 90–149 cm
8 = 150–249 cm
9 = Over 250 cm

Code 12. Ice Melting Stage (64)

0 = No melt
1 = Discolored ice
2 = Flooded ice
3 = Few puddles
4 = Many puddles
5 = Puddles with few thaw holes
6 = Puddles with many thaw holes
7 = Thaw holes, no puddles
8 = Rotten ice
9 = Refrozen or refreezing puddles

Code 13. Tide (69)

1 = High
2 = 3/4 outgoing
3 = 1/2 outgoing
4 = 1/4 outgoing
5 = Low
6 = 1/4 incoming
7 = 1/2 incoming
8 = 3/4 incoming

Code 14. Age (32)

P = Pullus (flightless young)
J = Hatching year (hatching date to spring molt: a bird capable of sustained flight)
S = Subadult (last year before adult plumage)
A = Adult

Code 15. Sex (33)

1 = Male
2 = Female

Code 16. Color Phase and Molt (34)

1 = Double light (all-white bird)
2 = Light (fulmar = white bird with some dark feathers on upper wing)
3 = Between light and intermediate
4 = Intermediate (fulmar = dark wings and some darkening of belly)
5 = Between intermediate and dark
6 = Dark (fulmar = bird dark except white spots on wings)
7 = Double dark (very dark bird)
8 = Breeding plumage
9 = Winter plumage
0 = Molt evident

Code 17. Bird Behavior (56–57)

00 = Undetermined
01 = Sitting on water
09 = Sitting on water next to ice
10 = Sitting on floating object
14 = Sitting on ice
15 = Sitting on land
20 = Flying in direct and consistent heading
29 = Flying, height variable
31 = Flying, circling ship
32 = Flying, following ship
34 = Flying, being pirated
35 = Flying, milling or circling (foraging)
48 = Flying, meandering
61 = Feeding at or near surface while flying (dipping or pattering)
65 = Feeding at surface (scavenging)
66 = Feeding at or near surface, not diving or flying (surface seizing)
70 = Feeding below surface (pursuit diving)
71 = Feeding below surface (plunge diving)
82 = Feeding above surface (pirating)
90 = Courtship display
98 = Dead

Code 18. Mammal Behavior (56–57)

00 = Undetermined
01 = Leaping
02 = Feeding
03 = Mother with young
04 = Synchronous diving
05 = Bow riding
06 = Porpoising
07 = Hauled out
08 = Sleeping
09 = Avoidance
14 = Curious/following
15 = Cetacea/pinniped association
16 = Pinniped/bird association
17 = Cetacea/bird association
18 = Breeding/copulation
19 = Moribund/dead

Code 19. Zone (60)

0 = Bird within count zone (= transect width)
1 = Ship follower
2 = Bird seen outside of count zone during a transect
3 = Bird seen within one-half hour before or after a transect or survey
4 = Bird on or over land during a transect or survey
5 = Bird on or over land before or after a transect or survey
6 = Bird found on ship before or after a transect or survey
7 = Dead on water

Appendix C. Taxonomic Code List for Selected Seabirds of the North-central Pacific Based on the National Oceanic Data Center System

Alpha code	Numeric code	Common name	Alpha code	Numeric code	Common name
NONE	91	No birds[b]	PHPE	9109020508	Phoenix petrel
UNBI	91	Unidentified bird[b]	HAPE	9109020509	Hawaiian petrel (dark-rumped petrel)[b,c]
UNLO	91070101	Unidentified loon[b]			
UNSL	91070101	Unidentified small loon[b]	BOPE	9109020510	Bonin petrel
UNLL	91070101	Unidentified large loon[b].	BWPE	9109020511	Black-winged petrel[b]
COLO	9107010101	Common loon	SOPE	9109020512	Solander's petrel[b]
YBLO	9107010102	Yellow-billed loon	STPE	9109020513	Stejneger's petrel[b]
ARLO	9107010103	Arctic loon	MUPE	9109020523	Murphy's petrel[b]
RTLO	9107010104	Red-throated loon	BUPE	9109020601	Bulwer's petrel[a]
UNGR	91080101	Unidentified grebe[b]	UNSP	910903	Unidentified storm-petrel[b]
RNGR	9108010101	Red-necked grebe	UDSP	910903020	Unidentified white-rumped storm-petrel[a,b]
HOGR	9108010102	Horned grebe			
UALB	910901	Unidentified albatross[b]	FTSP	9109030201	Fork-tailed storm-petrel
STAL	9109010101	Short-tailed albatross	LESP	9109030202	Leach's storm-petrel[b]
BFAL	9109010102	Black-footed albatross	BRSP	9109030205	Band-rumped storm-petrel[b]
LAAL	9109010103	Laysan albatross	SOSP	9109030208	Sooty storm-petrel[b]
UNPR	910902	Unidentified procellariid[b]	SWSP	9109030209	Swinhoe's storm-petrel[b]
NOFU	9109020201	Northern fulmar	WTTR	9110010102	White-tailed tropicbird
UNDS	91090204	Unidentified dark shearwater[b]	RTTR	9110010103	Red-tailed tropicbird
			MABO	9110030101	Masked booby
UNSH	91090204	Unidentified shearwater[b]	BRBO	9110030103	Brown booby
UNLS	910902040	Unidentified light shearwater[a,b]	RFBO	9110030104	Red-footed booby
			UNCO	91100401	Unidentified cormorant[b]
PISH	9109020402	Pink-footed shearwater[b]	DCCO	9110040102	Double-crested cormorant
FFSH	9109020403	Flesh-footed shearwater	BRCO	9110040104	Brandt's cormorant[b]
WTSH	9109020405	Wedge-tailed shearwater	PECO	9110040105	Pelagic cormorant
BUSH	9109020406	Buller's shearwater	RFCO	9110040106	Red-faced cormorant
SOSH	9109020407	Sooty shearwater	GRFB	9110060102	Great frigatebird[b]
STSH	9109020408	Short-tailed shearwater[b]	LEFB	9110060105	Lesser frigatebird[b]
NESH	9109020409	Newell's shearwater (Townsend's shearwater)[a,c]	UNDU	911201	Unidentified duck, goose, or swan[b]
SKSH	9109020413	Streaked shearwater[b]	WHSW	9112010201	Whooper swan[a,b]
UNPT	91090205	Unidentified *Pterodroma*[b]	TUSW	9112010202	Tundra swan[a]
MOPE	9109020503	Mottled petrel	TRSW	9112010203	Trumpeter swan[b]
HEPE	9109020504	Herald petrel	CAGO	9112010301	Canada goose
COPE	9109020505	Cook's petrel[b]	BRAN	9112010303	Brant[b]
KEPE	9109020506	Kermadec petrel[b]	EMGO	9112010401	Emperor goose
WNPE	9109020507	White-necked petrel[b]	WFGO	9112010501	Greater white-fronted goose[b]

Alpha code	Numeric code	Common name	Alpha code	Numeric code	Common name
SNGO	9112010601	Snow goose[b]	BLKI	9128020301	Black-legged kittiwake[a]
UNPD	91120109	Unidentified puddle duck[b]	RLKI	9128020302	Red-legged kittiwake[a]
MALL	9112010901	Mallard	ROGU	9128020401	Ross' gull[a]
NOPI	9112010907	Northern pintail	SAGU	9128020501	Sabine's gull[a]
GWTE	9112010910	Green-winged teal[b]	UNTE	91280207	Unidentified tern[b]
AMWI	9112010916	American wigeon	COTE	9128020703	Common tern
NOSH	9112010917	Northern shoveler[b]	ARTE	9128020704	Arctic tern
GRSC	9112011106	Greater scaup	ALTE	9128020706	Aleutian tern
LESC	9112011107	Lesser scaup[b]	GBTE	9128020710	Gray-backed tern[a,b]
UNGO	91120112	Unidentified goldeneye[b]	SOTE	9128020707	Sooty tern
COGO	9112011201	Common goldeneye	BRNO	9128021101	Brown noddy
BAGO	9112011202	Barrow's goldeneye	BLNO	9128021102	Black noddy
BUHE	9112011203	Bufflehead[b]	WHTE	9128021201	White tern[a]
OLSQ	9112011301	Oldsquaw[b]	UNAL	912901	Unidentified alcid[b]
HADU	9112011401	Harlequin duck[b]	UNSA	9129010	Unidentified small alcid[a,b]
UNEI	91120117	Unidentified eider[b]	SDAL	9129010	Small dark alcid[a,b]
STEI	9112011601	Steller's eider	UNLA	91290100	Unidentified large alcid[a,b]
COEI	9112011701	Common eider	UNML	912901000	Unidentified murrelet[a,b]
KIEI	9112011702	King eider	UNMU	91290103	Unidentified murre[b]
SPEI	9112011703	Spectacled eider	COMU	9129010301	Common murre
UNSC	91120118	Unidentified scoter[b]	TBMU	9129010302	Thick-billed murre
WWSC	9112011802	White-winged scoter	DOVE	9129010401	Dovekie
SUSC	9112011803	Surf scoter	UNGI	91290105	Unidentified guillemot[b]
BLSC	9112011804	Black scoter	BLGU	9129010501	Black guillemot
UNME	91120121	Unidentified merganser[b]	PIGU	9129010502	Pigeon guillemot
COME	9112012101	Common merganser	BRMU	91290106	*Brachyramphus* murrelet[b]
RBME	9112012102	Red-breasted merganser	MAMU	9129010601	Marbled murrelet
HOME	9112012105	Hooded merganser	KIMU	9129010602	Kittlitz's murrelet
UNPH	912707	Unidentified phalarope[b]	ANMU	9129010801	Ancient murrelet
REPH	9127070101	Red phalarope	JAMU	9129010802	Japanese murrelet
RNPH	9127070301	Red-necked phalarope	CAAU	9129010901	Cassin's auklet
UNJA	912801	Unidentified jaeger[b]	USDA	9129011	Small dark auklet (CAAU, WHAU, LEAU, CRAU)[a,b]
POJA	9128010101	Pomarine jaeger			
PAJA	9128010102	Parasitic jaeger	PAAU	9129011001	Parakeet auklet
LTJA	9128010103	Long-tailed jaeger	UNAE	91290111	Unidentified *Aethia* auklet[b]
SPSK	9128010202	South polar skua	CRAU	9129011101	Crested auklet
UNGU	91280201	Unidentified gull[b]	LEAU	9129011102	Least auklet
UNLG	912802010	Unidentified large gull[a,b]	WHAU	9129011103	Whiskered auklet
GLGU	9128020101	Glaucous gull	RHAU	9129011201	Rhinoceros auklet
GWGU	9128020103	Glaucous-winged gull	UNPU	91290113	Unidentified puffin[b]
SBGU	9128020105	Slaty-backed gull	HOPU	9129011302	Horned puffin
HEGU	9128020108	Herring gull[b]	TUPU	9129011401	Tufted puffin
GHGU	912802010899	Glaucous-winged × herring gull hybrid[a,b]	UNPO	921802	Unidentified porpoise[b]
			CODO	9218020601	Common dolphin[b]
BTGU	9128020112	Black-tailed gull	NRWD	9218021001	Northern right-whale dolphin[b]
MEGU	9128020113	Mew gull			
BOGU	9128020117	Bonaparte's gull	RIDO	9218021101	Risso's dolphin[b]
IVGU	9128020201	Ivory gull[a]	KIWH	9218021601	Killer whale[b]
UNKI	91280203	Unidentified kittiwake[a,b]	HAPO	9218021801	Harbor porpoise[b]

Alpha code	Numeric code	Common name	Alpha code	Numeric code	Common name
DAPO	9218022001	Dall's porpoise[b]	UNPI	92210	Unidentified seal or sea lion = pinniped[b]
SPWH	9218040102	Sperm whale[b]			
UBKW	921805	Unidentified beaked whale[b]	CASL	9221010301	California sea lion[b]
UNBW	9219	Unidentified baleen whale[b]	STSL	9221010501	Northern sea lion[b]
GRWH	9219010101	Grey whale[b]	NOFS	9221010601	Northern fur seal[b]
MIWH	9219020101	Minke whale[b]	WALR	9221020101	Walrus[b]
SEWH	9219020103	Sei whale[b]	UNSE	922103	Unidentified seal[b]
FIWH	9219020104	Fin whale[b]	LASE	9221030101	Spotted seal[b]
HBWH	9219020201	Humpback whale[b]	RISE	9221030102	Ringed seal[b]
BOWH	9219030102	Bowhead whale[b]	RBSE	9221030106	Ribbon seal[b]
POBE	9220010101	Polar bear[b]	HASE	9221030107	Harbor seal[b]
SEOT	9220020101	Sea otter[b]	BESE	9221030301	Bearded seal[b]

[a] Numeric code is not standard NODC.
[b] Alpha code does not conform to the *North American Bird Banding Manual* being prepared by the U.S. Department of the Interior, Fish and Wildlife Service, and Environment Canada, Canadian Wildlife Service.
[c] Parentheses shows current usage found in *Check-List of North American Birds*, 6th ed., 1983. American Ornithologists' Union, Washington, DC.

Life History Forms

Examples of completed Life History Forms (LHF's) are provided. Study these closely. Data recorded on the LHF's will be entered on the computerized, cumulative life history data base. Your cooperation in completing the LHF's in meticulous accord with the instructions provided will decrease the probability of undetected errors in the data base.

1. The information on the LHF is the PERMANENT RECORD for each porpoise dissected in the field. Any errors or discrepancies discovered during editing of the computerized life history data base or during analysis of specimens and data in the laboratory will be checked against the data/information noted on the LHF. Any errors or discrepancies which can not be resolved result in a waste of time and effort, since the entire data set for those dissected porpoise must be deleted from analysis.

2. While you are dissecting PRINT all notations for each item on the LHF to the left of the corresponding coding block, including the number of the bucket in which the collected specimen is stored. Do not directly code LHF's while you are dissecting.

3. Double check your written notations on the LHF's against the specimens collected and examinations performed before each carcass is discarded.

4. If for any reason you do not collect a specimen or do not perform a requested examination, write NOT CHECKED or N/C in the space to the left of the corresponding coding block.

5. After dissections are completed for the day, code the LHF's and recheck all data and code entries.

6. If there is any discrepancy or error which can not be resolved with total certainty, note this at the top of the LHF.

7. If there is a discrepancy or error which can be resolved with absolute certainty, line through the data in error (leave it legible) and write the correct data above.

8. If there is a discrepancy or error which is discovered after the day of dissection and can be resolved with unquestionable certainty, line through the data (leave it legible) with a BLUE pencil and write the correct data above in BLUE pencil.

Field Specimen Numbers, Labels/Tags, and Preservation of Specimens

1. The Personal Specimen Numbers are the primary identification number assigned to every porpoise which is at least measured for body length and sexed. The personal specimen number consists of each observer's three initials and a 3-digit number indicating his running lifetime dissection tally, e.g. AGH 167.

If you have collected marine mammal specimens for NMFS in previous seasons or you have used an identical system for identifying biological specimens collected elsewhere, make certain that specimen numbers are continued in unbroken sequence and particularly, avoid duplicating the same personal specimen number for two (or more) separate animals. Each personal specimen number is unique for identifying the specimens and data collected from any one particular animal. Duplication of personal specimen numbers will cause incalculable havoc in analyzing and cataloging the specimens and life history data for the marine mammal and parts so numbered.

If you have not previously collected biological specimens which have been catalogued, or you have used a different system for identifying collected biological specimens, begin your personal specimen number series with 001.

Personal Specimen Number for fetuses consists of the personal specimen number assigned to the cow (mother) followed by an "F". Example: fetus and specimens from the fetus of cow ARD 015 = ARD 015F.

2. Specimen Labels/Tags - PRINT distinct, bold block letters and numerals which can be EASILY and CLEARLY READ. Use the fine tip waterproof markers provided.

Specimen label/tags should include the following information:

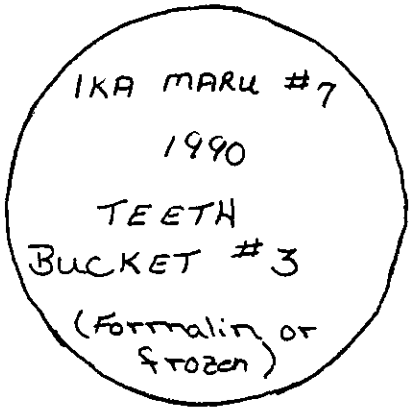
1. Vessel name, including number, and last 2 digits of the year.
2. Personal specimen number.
3. Species
4. Description of specimen.

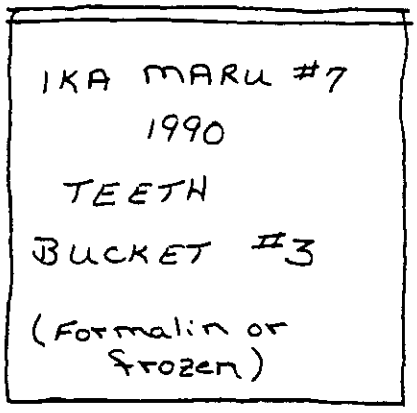
Example: aboard the Kizan Maru during the 1990 season, observer RAR dissects his 25th marine mammal (a northern right whale dolphin). The specimen collected is lung tissue with parasite cyst.

KIZAN MARU #28 90
RAR 025
LISSODELPHIS BOREALIS
LUNG -- W/ PARASITE CYST

Specimen bucket labels should include the following information:

1. Vessel name, including number, licence, and year of specimen collection.
2. Description of specimen.
3. Bucket number - must correspond with inventory sheet.





3. Preservation of Specimens - the "Specimen Disposition Chart" summarizes the preservation method for each biological specimen which is to be collected. In addition, note the following:

a. Formalin/formaldehyde preservation

1. Dilute the 100% stock formalin provided (37% formaldehyde) 9:1 with water (fresh or saltwater) to make the 10% storage/fixing solution.

2. Rinse excess blood from specimens before placing them in the formalin solution. These organic substances can quickly dilute the fixing capability of the solution.

3. After each day's collection, agitate the specimens in the fixing bucket gently to allow unfixed tissue to come into direct contact with the fixing solution.

4. When the storage bucket is approximately 3/4 full of specimens, add approximately 250ml additional formalin and mix carefully. Do NOT pack specimens too tightly in the specimen buckets. Leave specimens loose so that sufficient space is allowed for the solution to directly contact the entire surface of each specimen.

5. Mark each bucket containing formalin preserved specimens with a short length of colored tape. The tape will function as a reminder to avoid freezing any bucket containing formalin preserved specimens. Vessel operators should be notified of this procedure.

6. During the transit back from the fishing grounds pour off the formalin solution and repackage the fixed specimens in ziplock bags. Double bag all specimens, then replace them in the bucket and seal the lid.
CAUTION: when working with formalin/formaldehyde solution, make certain that your hands are protected with gloves and the work area is well ventilated. If any of the solution contacts your eyes, skin, or clothing, immediately flush the area with freshwater. If any of the solution is spilled on deck, wash the area with copious quantities of seawater.

b. Frozen Specimens - ensure that once specimens are frozen that they are not allowed to thaw, and/or refreeze. The preferred constant storage temperature range is -20° to -5°F.

Collection of Biological Data and Specimens

Note: It is IMPERATIVE that all recorded data are accurate and complete and that all specimens are meticulously collected, labeled, and preserved. Any errors, discrepancies, or omissions may require that all the life history data and specimens for that particular animal be deleted from further analysis at the laboratory.

1. Biological Data - for each porpoise saved, collect the following data and record it the appropriate space on the Life History Form (LHF):

a. Assign and record a personal specimen number for each porpoise which is at least measured for body length and sexed.

b. Determine the species and sex.

c. Sketch the color pattern on the silhouette provided on the LHF. Include location of scars, Crassicauda tracks, diatoms, and unusual characteristics. Additional space for describing external morphological characteristics is available on the reverse side of the LHF, section titled "Notes".

d. Measure whole body length, i.e. the straight line measure of the distance from the tip of the rostrum to the fluke notch (nearest centimeter).

e. Photograph each porpoise in accordance with the following guidelines:

1. One, full frame, left lateral view and one full frame ventral view, i.e. tip of rostrum near one margin of the frame and the flukes at the opposite margin.

2. All photos must be taken at right angles to the animal. In other words, the animal must be placed squarely in front of you.

3. Position animals against a contrasting background and/or where direct sunlight does not illuminate the body. Avoid photographing toward bright sunlight. Wipe excess moisture off the body surface photographed to decrease reflected light from the flash unit.

4. Within the frame of each photo, place a specimen identification card. (a 3" x 5" colored index card, listing the vessel name and number, year and personal specimen number. EXAMPLE:

IKA MARU #7 1990

J00 Ø12

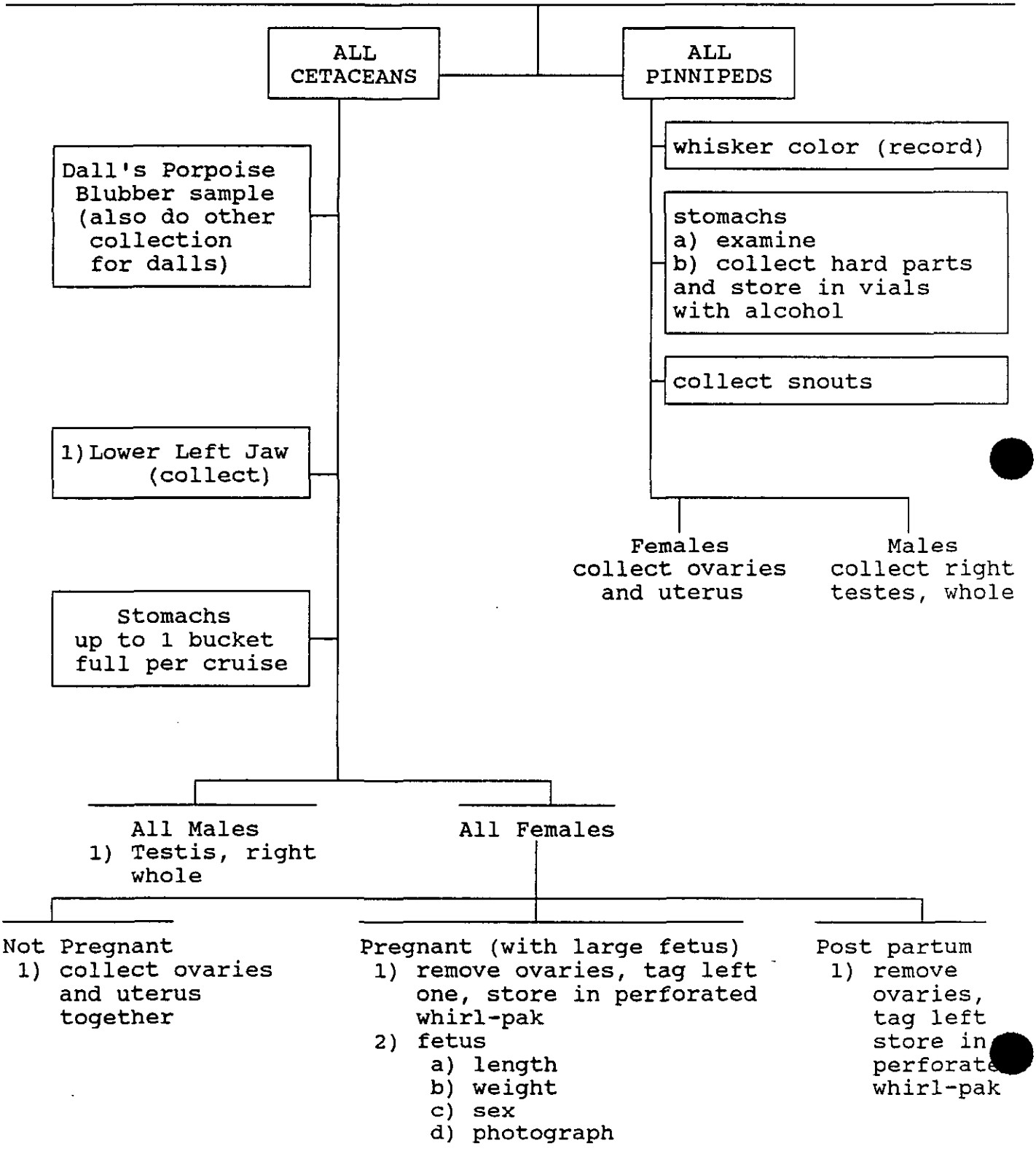
LISSODELPHIS BOREALIS.

5. For fetuses, photograph one full frame view of left lateral side. Be sure to place a Photo Identification Card in the frame. Note on the LHF with sex, length (to the nearest 0.1 cm) and weight (to the nearest 0.1 kg).

FLOWCHART FOR MARINE MAMMAL BIOLOGICAL SAMPLING

ALL ANIMALS

1.) Species Identification
2.) Photographic verification
3.) Sex
4.) Length
5.) Life History Form
6.) Master Logbook Notation



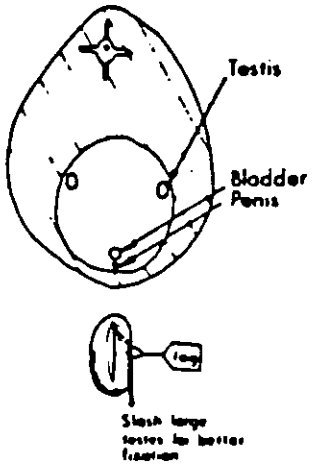
Biological Specimens - collect the following specimens from all animals that you dissect.

a. Teeth: remove left lower jaw with teeth intact. Tag specimen, prepare for storage as outlined below, and freeze. Note on LHF and on the appropriate Specimen Inventory list.

b. Reproductive organs - males:

1. Remove the RIGHT testis and epididymis.

2. Attach a specimen tag securely between the testis and the epididymis.



3. If testis is longer than 3" (7 cm), make one or two sagittal incisions to about 1/2 the diameter of the organ to provide greater surface areas for the formalin solution to penetrate and fix the tissue.

4. Rinse testis with water to remove excess blood.

5. Place tagged testis loose in the storage bucket containing 10% formalin. Do NOT place the testes in plastic bags or whirl-paks.

6. Note collection and storage bucket number on LHF. Record collection on the appropriate Specimen Inventory list.

7. Note "not applicable" (N/A), for specimens/data specific for females on the LHF, i.e. ovaries, uterus, lactation status, and fetus.

Reproductive organs - females:

1. Mammary gland examination and specimens

   a. check for lactation or presence of colostrum (honey-colored, viscous fluid) by making a sagittal incision along the entire length of the left mammary gland and check for presence/absence of milk or colostrum. Note on LHF.

   b. Measure left mammary gland depth, at its thickest section, to the nearest 0.1 cm. Record on LHF.

2. Reproductive tracts

   a. Immature or non pregnant female

   1. Resect the LEFT uterine horn

   2. Attach a specimen tag around the uterine horn and forward of the ovary. Leave a space of at least one inch between the ovary and the string. DO NOT TIE THE TAG DIRECTLY AROUND THE OVARY.

   3. Resect the reproductive tract as a unit. Be careful not to puncture or lacerate the uterine walls.

   4. Rinse reproductive tract with water to remove excess blood.

   5. Place tagged reproductive tract loose in the storage bucket containing 10% formalin.

   6. Note collection and number of storage bucket on LHF. Record collection on the appropriate Specimen Inventory list. Enter not applicable, N/A, for specimen/data specific for males, i.e. testis.

   DO's: 1. Daily, once per day, GENTLY stir contents of the ovaries bucket to ensure the specimens fix properly.

DON'Ts: 1. Do NOT pack the specimens tightly

   2. Do NOT place reproductive tracts in whirl-paks or other plastic bags.

   3. Do NOT tie specimen tags directly around the ovary.

b. Pregnant females:

1. Resect LEFT ovary with some uterine horn tissue attached.

2. Attach the specimen tag securely to the uterine horn tissue at least 2 inches away from the left ovary. DO NOT TIE THE TAG DIRECTLY AROUND THE OVARY or so close to it that the shape of the is distorted.

3. Resect RIGHT ovary. Place both ovaries in one perforated whirl-pak and preserve in 10% formalin of. Do not pack the ovaries tightly in the whirl-pak as this tends to distort their shape.

4. Note collection and number of storage bucket on LHF. Note not applicable, N/A, for specimens/data specific for males, i.e. testis.

c. Stomachs:

1. Tie off each end of the stomach, at a portion of the esophagus forward of the forestomach and on the duodenum posterior to the duodenal ampulla to prevent stomach contents from oozing out.

Caution: Be careful not to ties the knots so tight that the twine cuts through the tissue of the esophagus and/or the duodenum.

2. Securely attach a tag to either end of the specimen.

3. Resect the stomach from the abdominal cavity.
Caution: Be careful not to puncture any of the stomach chambers

4. Rinse stomach with water to remove excess blood.

5. Place in ziplock bag.

6. On a 3" x 5" index card, print the following information in bold block letters:

a. Vessel name and year of collection

b. Personal specimen number

c. Description of specimen, i.e. Neonate

7. Position the card so that it is easily read from the outside of the bag, press out excess air, and then seal.

8. Place in Stomach storage bucket and freeze. Do NOT preserve in formalin.

9. Note collection and storage bucket number on LHF.

d. Parasite survey and collect specimens - Dall's Porpoise only
Resect a patch of blubber on the animal's left side which measures 14" x 7". Carry the incision along the midline 7" anterior and 7" posterior of the genital slit and 7" up the side of the body. Tag by running string through a hole in the skin. Stack the samples in a bucket lying on its side (i.e. do not stack flat in the bucket starting from the bottom) and store frozen. NOTE: if time allows, you may examine the blubber sample for evidence of phyllobothrium instead of collecting the sample. Do so by making 1/4" cuts across the blubber and examing the exposed surfaces for the parasite which will appear as a tannish color pea shaped cyst approximately 1/8-1/4" across. comparison samples can be provided. Record the number of cysts found under a "phyllobothrium notation" made under the special collections section of the Life History Form.

SPECIMEN DISPOSITION CHART

Specimen	Preservation Method	Remarks
Stomachs	Freeze	-Tie off both end -securely attach 1 tag to tie off string -place a 3" x 5" index card with personal specimen number in plastic bag with stomachs
Jaw section	Freeze	-1 tag/jaw, securely tied
Testis, whole - large	Formalin	-attach tag securely around epididymis -make incision lengthwise 1/2 way through organ to promote fixing
Testis, whole - small	Formalin	-attach tag securely around epididymis
Ovaries and uterus (non-pregnant females)	Formalin	-tie tag around left uterine horn forward of ovary -do NOT tie tag around ovary
Ovaries (pregnant females or post partum)	Formalin	-tag left ovary -remove ovaries from uterine horns -do NOT tie tag around ovary; leave a small section of the uterine horn attached as a place to secure tag -place both ovaries in perforated whirl-pak
Blubber patch		-Dall's porpoise only -tag -place carefully in bucket before freezing

Collection of Biological Specimens and Data for Other Marine Mammals

1. Pinnipeds
   a. Northern sea lion (Eumetopius jubatus) and northern fur seals (Callorhinus ursinus)

      1. Assign and record a personal specimen number.

      2. Note the date, position of take, and operation number.

      3. Determine the species and sex.

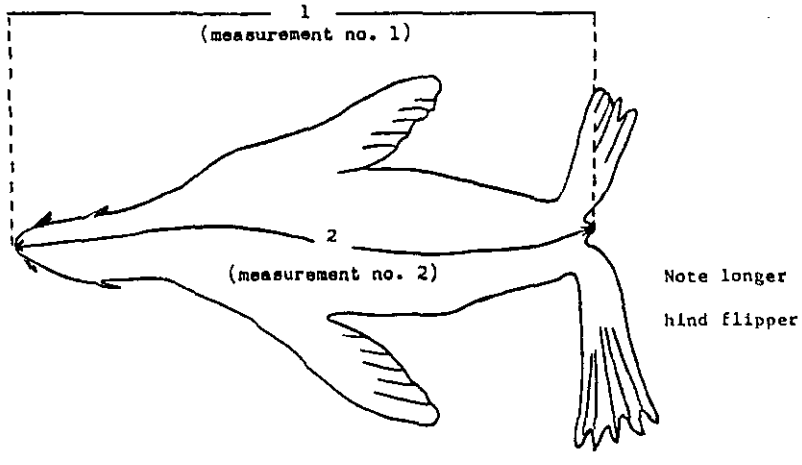
      4. Note any scars, unusual marking, tags or brands, etc., on LHF.

      5. Photograph - full frame photographs, lateral, ventral, and anything unusual.

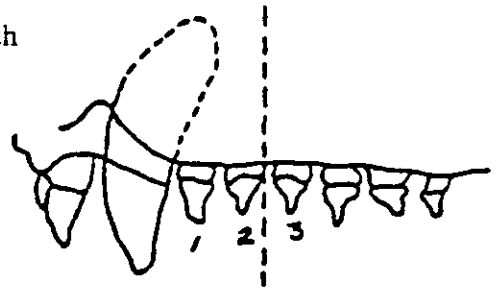
      6. Measure body length (see following instructions).

Standard Length (measurement no. 1) is the straight-line distance from snout to tip of tail flesh on the unskinned body, belly up, ideally with the head and vertebral column on a straight line. If rigor has set in, then this measurement probably cannot be taken and measurement no. 2 should be taken.

Curvilinear Length (measurement no. 2) is taken when the seal cannot be stretched belly up, as when rigor sets in, or is too heavy to be moved. It is the shortest surface distance from snout to tip of tail flesh along back, belly, or side. Record the type of measurement taken.



7. Collect
   a. canine teeth



View of fur seal teeth (upper jaw)

The procedure in collecting a tooth from a seal are as follows:

1. Skin and cut off snout, taking care not to damage the root of the upper canine tooth.

2. To insure that the entire upper canine root is collected, the snout should be cut off between the 2nd and 3rd post canine teeth at dotted line (see figure).

3. Freeze or dry snout, do not preserve in formalin.

b. Reproductive tract - female with all white whiskers. Attach specimen tag to left uterine horn and preserve in 10% formalin. Do NOT tie the tag directly around the ovary.

c. Stomach - tie off both ends, resect, and freeze.

PORPOISE LIFE HISTORY FORM– 1987

Observer aboard U.S.☐ JFA☐ None☐ Catcherboat name/no. IKA MARU #7

Card 1 (1) Cruise no. (2–5) Mothership specimen no. Specimen no. J00 008 (6–12)

Species/stock Phocoenoides dalli (dalli) PD (13–14) Sex 2 (1=Male 2=Female) (15)

Total length (cm) 0194 (16–19) Total weight (kg) (20–23)

Haul date (yr/mo/day) 910605 (24–29) Capture position (lat/long) 3941 1757 (30–38) Quadrant 0 (0=NW 2=NE) (39)

Specimens and measurements (1=yes 2=no 3=not applicable 4=with head, carcass)

Carcass	No	2 (40)	Mammary tissue	No	1
Head	No	2 (41)	Mammary depth (cm)	0.9	
Teeth	Yes	1 (42)	Corpus Luteum (1=left 2=right 3=none)		
Stomach	YES	1 (43)	Pancreas	No	2
Testis	NA	3 (44)	Lung	No	2
Ovaries	YES	1 (45)	Blubber	Yes	1
Uterus	YES	1 (46)	Blood	No	2
Female lactating? (1=yes 2=no 3=colostrum)	No	2 (47)			

Special Collections

Fetus data*

Sex* (1=Male 2=Female) (48)

Fetus length (cm)* (49–52)

Fetus weight (kg)* (53–55)

Fetus color type:

Fetus position (1=left horn 2=right horn)

* Note: If fetus is less than 30 cm, leave in uterus and preserve. Do not sex and measure in field.

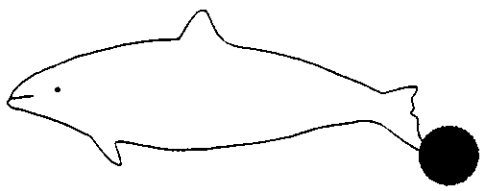
Photos

	Roll no.	Frame no.
Left lateral	1	18
Ventral	1	19
Other (explain)		

Electrophoresis samples

Heart	NO	2
Liver	No	2
Kidney	No	2
Muscle	NO	2

Fetus or unusual marks



Observer's name JOE O. OBSERVER

Date of dissection 5 JUNE 90 Time of dissection

Notes on overleaf ☐ (1=yes 2=no)

EXAMPLE: FEMALE NOT PREGNANT

PORPOISE LIFE HISTORY FORM– 1987

Observer aboard U.S. ☒ JFA ☐ None ☐ Catcherboat name/no. IKA MARU No 7

Card 1 (1) Cruise no. (2–5) Mothership specimen no. Specimen no. J00 007 (6–12)

Species/stock LISSODELPHIS borealis 13 14

Sex (1=Male 2=Female) 2 (15)

Total length (cm) 0211 (16–19) Total weight (kg) (20–23)

Haul date (yr/mo/day) 900604 (24–29) Capture position (lat/long) 3929 17808 (30–38) Quadrant (0=NW 2=NE) 0 (39)

Specimens and measurements (1=yes 2=no 3=not applicable 4=with head, carcass)

Carcass	NO 2 (40)	Mammary tissue	N/A 3	Special Collections	
Head	NO 2 (41)	Mammary depth (cm)	.		
Teeth	YES 1 (42)	Corpus Luteum (1=left 2=right 3=none)	NA		
Stomach	YES 1 (43)	Pancreas	NO 2		
Testis	YES 1 (44)	Lung	NO 2		
Ovaries	N/A 3 (45)	Blubber	NO 2		
Uterus	N/A 3 (46)	Blood	NO 2		
Female lactating? (1=yes 2=no 3=colostrum)	(47)				

Fetus data*

Sex* (1=Male 2=Female) (48)

Fetus length (cm)* (49–52)

Fetus weight (kg)* (53–55)

Fetus color type:

Fetus position (1=left horn 2=right horn)

* Note: If fetus is less than 30 cm, leave in uterus and preserve. Do not sex and measure in field.

Photos

	Roll no.	Frame no.
Left lateral	1	27
Ventral	1	28
Other (explain)		

Electrophoresis samples

Heart	NO	2
Liver	NO	2
Kidney	NO	2
Muscle	NO	2

Fetus or unusual marks

Observer's name JOE O. OBSERVER

Date of dissection 4 June 90 Time of dissection

Notes on overleaf (1=yes 2=no) ☐

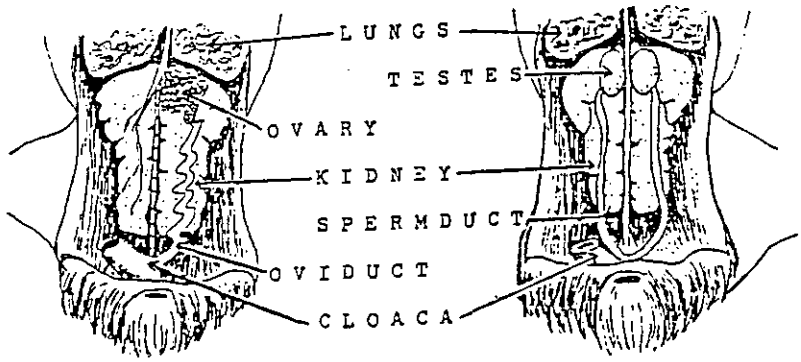
EXAMPLE: MALE

SEABIRD DISSECTIONS

Data should be collected from at least the first 30 specimens of each species for each haul. Complete the Supplementary Seabird Data Form for each specimen dissected.

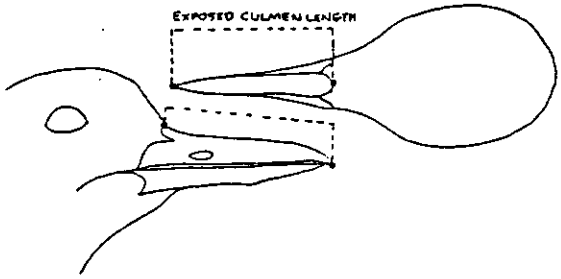
Sexing and Gonad Condition

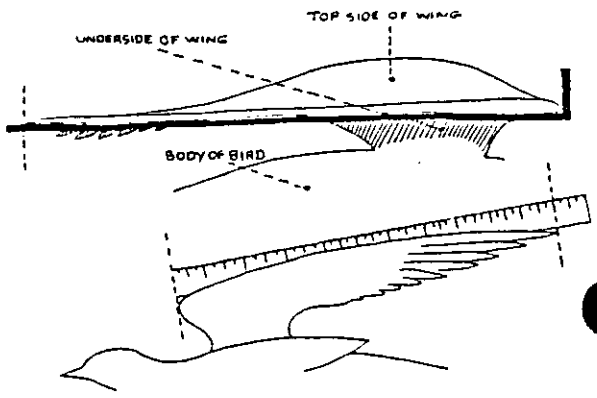
In order to sex the bird cut the carcass from the vent up the left side and through the ribs. In the male, the testes are a pair of whitish or blackish bean-shaped bodies lying near the mid-line. In the female the ovary is a cluster of granular, or small, rounded ova, in the same area (usually on the left side and only one, occasionally paired; note any abnormalities on label). During the breeding season the gonads are huge and easy to find; at other times of the year and in young birds, they are very small and difficult to locate. Record the sex. Do not guess if you are not sure.



Body Measurements

The exposed culmen (bill) is measured as the straight line distance from its tip to where it ends at the skin or feathers of the forehead. The wing length is the distance from the wrist's outer edge to the tip of the longest primary feather in a relaxed and folded wing. If the longest primary is missing or still growing do not measure the wing. To weigh the specimen place it in a bag of known weight, weigh bag and bird together, subtract weight of bag from weight of bag and bird and record the difference.



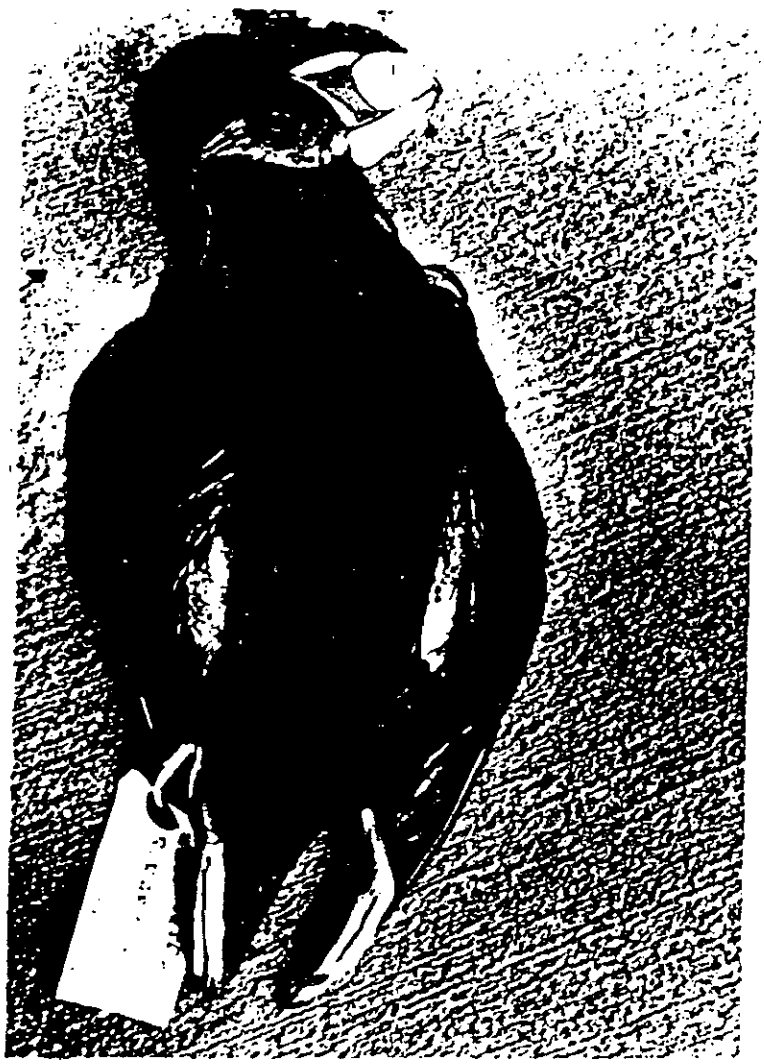


Color Phase

The only species you are likely to encounter which has a number of color phases is the northern fulmar. In the Pacific, light phase fulmars predominate at northern colonies in the Bering Sea and dark phase birds predominate at more southern colonies. Light phase birds are pale grey (becoming brownish with wear) above with white heads and white below. Dark phase birds have mostly dark grey to brown bodies. Intermediate birds will have large amounts of both light and dark in plumage.

Brood Patch

Prior to incubation, most species of birds develop a brood patch on the ventral surface of the body. Usually there is only one patch, but in some species such as the tufted puffin there are two. The patch is an area of bare and thickened skin richly supplied with blood vessels to aid transfer of body heat to the egg. The patch refeathers with the acquisition of winter plumage. If present, the patches are easily found by searching through the feathers on the ventral surface of the bird.



Molt

Most birds replace their feathers at least once a year. This replacement is generally orderly and symmetrical, especially in the primaries and rectrices. Most migrating seabirds begin molt once they have reached their nonbreeding areas and it is completed before they return to breeding areas. Molt can be determined by visual examination of the feathers of the wing, tail, and body. New feathers will look quite different from old feathers because they will be unworn and unfaded, and if still growing they will have a sheath around the base. Growing feathers have a large supply of blood which, viewing the skin from the inside, creates a very obvious fat and blackish area at the base of each feather. Missing primaries and rectrices leave gaps in the wings and tail (the same feathers on both wings and both sides of the tail usually molt at the same time) which appear as whitish areas because the bases of nearby feathers show through the gap.

Age

It will frequently be impossible for you to determine the age of a bird. For some species, however, you will be able to distinguish immatures from subadults from adults by plumage characteristics. The principal groups of marine birds for which plumage characters can be used to age specimens include: albatross, tropicbirds, pelicans, boobies, cormorants, frigatebirds, skuas/jaegers, and gulls. The two most important species you may have to deal with are short-tailed and black-footed albatross.

Short-tailed Albatross - First year birds are solid brown all over. As they age, the belly and face become white and white patches form on the upper wings. Subadults look much like adults but still have a dark cervical collar. Adults have white heads and backs.

Black-footed Albatross - First year birds are solid dusky brown. As they age they develop areas of white around the bill and base of tail. The older the bird, the more white. Since the difference between subadult and adult is merely one of amount of white, you will not be able to distinguish adults from subadults but you will be able to recognize and record immatures.

Other characters sometimes used to age birds include size and condition of gonads, characteristics of the bill (e.g., first year Pterodroma usually have very small nails on the tip of the bill, and the presence of a Bursa of Fabricius in young birds. The Bursa of Fabricius is a blind outpocketing of the dorsal wall of that part of the cloaca nearest the vent. In spring and early summer, feather wear can be used to tell most adult shearwaters and gadfly petrels. Young birds will have just grown their wing and tail feathers so they will look very fresh. Adults, on the other hand, will have very worn wing and tail feathers at that time of year. Skull ossification can also be used to age many species of birds. Immature birds will have "windows" of thin bone on top of the skull which look transparent compared to surrounding areas of the skull.

Recording Supplementary Seabird Data

1. Enter your name and vessel name in the spaces provided.

2. Enter the source code in block 1.

3. Enter the fishery code in blocks 2-3.

4. Enter the license number in blocks 4-6.

5. Enter the year in blocks 7-8.

6. Enter the operation number in blocks 9-11.

7. Enter the sea surface temperature in tenths of degrees in blocks 12-14.

8. Enter the section number in columns 15-16.

9. Enter the species code in columns 17-19.

10. Enter the color phase code in column 20.
    - 0 = Unknown
    - 1 = Light
    - 2 = Intermediate
    - 3 = Dark

11. Enter the sex code in column 21.
    - 0 = Unknown
    - 1 = Male
    - 2 = Female

12. Enter the age code in column 22.
    - 0 = Unknown
    - 1 = Pullus (Flightless young)
    - 2 = Immature (Flying young)
    - 3 = Subadult
    - 4 = Adult

13. Enter the brood patch code in column 23.
    - 0 = Unknown
    - 1 = Present
    - 2 = Absent

14. Enter the molting code in column 24.
    0 = Unknown
    1 = Wing molt
    2 = Tail molt
    3 = Body molt
    4 = Combination of 1, 2, and 3

15. Enter the weight, in grams, in columns 25-28.

16. Enter the bill length, in millimeters, in columns 29-31.

17. Enter the wing length, in millimeters, in columns 32-34.

18. Enter the prey in stomach code in column 35.
    0 = Unknown
    1 = Fish
    2 = Squid
    3 = Invertebrates
    4 = Fish and Squid
    5 = Fish and Invertebrates
    6 = Squid and Invertebrates
    7 = Fish, Squid, and Invertebrates

19. Enter the stomach contents code in column 36.
    0 = Unknown
    1 = 75% - 100% Full
    2 = 50% - 74% Full
    3 = 25% - 49% Full
    4 = 1% - 24% Full
    5 = Empty

20. Under notes, enter any special features of the specimen including the presence or absence of bands and tags and their numbers. If possible, bring the bands and tags back.

U.S. FISH AND WILDLIFE SERVICE

INCIDENTAL CATCH OF MARINE BIRDS
SQUID DRIFTNET FISHERY

SUPPLEMENTARY DATA

VESSEL NAME _____ OBSERVER NAME _____

SC	FISH. CODE		LIC. NO.			YR		OPS. NUMBER			S.S. TEMP.		
1	2	3	4	5	6	7	8	9	10	11	12	13	14

SEC NO.		SPECIES			CP	SX	AG	BP	ML	WEIGHT	BILL	WING	PS	SC	NOTES/ BAND #
15	16	17	18	19	20	21	22	23	24	25-28	29-31	32-34	35	36	

3.4.5 Biological Sampling of Albacore, Other Non-Salmonid Fishes, and Squid

Background

Non-salmonid fishes comprise a significant component of the catch by North Pacific high-seas driftnet vessels. In the squid driftnet fisheries of Japan, Taiwan, and Korea they account for the largest percentage of marine life taken incidentally. Some of the non-salmonid species, such as albacore, other tunas, and billfishes, are of considerable economic importance and are generally retained for commercial processing by the squid vessels. In the large-mesh driftnet fisheries of Japan and Taiwan, tunas and billfishes are of course the target species.

In both squid and large-mesh driftnet fisheries, the commercially valuable fishes also include such shark species as salmon shark, shortfin mako shark, and thresher shark, and other species such as mahimahi, wahoo, and yellowtail. These are usually retained and either marketed in some form or utilized aboard the vessels. In addition, there are numerous other non- salmonid fishes which are taken incidentally by both squid and large-mesh driftnet vessels and either discarded or only minimally processed. This group includes Pacific pomfret and blue shark, which make up a significant part of the incidental fish catch.

In any case, accurate estimation of the catch and dropout rates for all of these marine fishes is critical to comprehensive assessment of high- seas driftnet fishery impacts. Further, to adequately assess driftnet fishery impacts on key marine fish populations it will be necessary to know the length-composition of the major species caught. Observers will collect such information according to the following guidelines. Guidelines vary depending on whether an observer is on a Japanese, Korean, or Taiwanese vessel; these differences are indicated.

The guidelines first cover species identification for marine fishes and procedures for documenting ID's with photographs. Then the procedures for length-frequency sampling of marine fishes are described. Finally, instructions are given for collecting and freezing specimens of small albacore.

A. Key species list

The observer agreements include various provisions for collecting length frequency data on non-salmonid fishes. Although the intent of the agreements is to provide very wide latitude in biological sampling, the marine fish length-frequency sampling effort will be confined to a list of key species or to a subset of species on the list. These species have been divided into two groups according to the preferred length measurement, as follows:

Group A species:

Albacore	Thunnus alalunga
Yellowfin Tuna	Thunnus albacares
Bigeye Tuna	Thunnus obesus
Bluefin Tuna	Thunnus thynnus
Skipjack Tuna	Katsuwonus pelamis
Pacific Pomfret	Brama japonica
Yellowtail	Seriola lalandi
Mahimahi	Coryphaena hippurus
Wahoo	Acanthocybium solandri

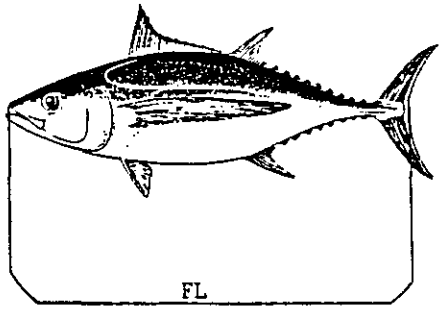


Fig. 1.--Fork length measurement (shown here on albacore.

The standard fork length (FL) will be measured in Group A species.

Group B species:

Striped marlin	Tetrapturus audax
Shortnose spearfish	Tetrapturus angustirostris
Blue marlin	Makaira mazara
Swordfish	Xiphias gladius
Blue shark	Prionace glauca
Salmon shark	Lamna ditropis
Thresher shark	Alopias vulpinus
Shortfin mako shark	Isurus oxyrinchus

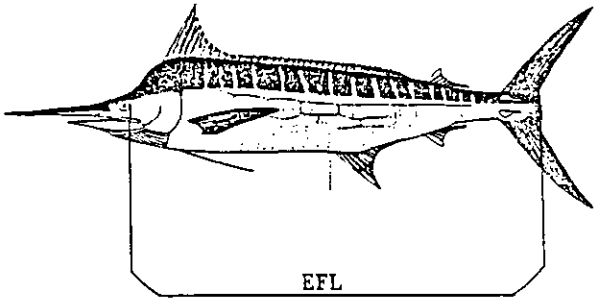


Fig. 2.--Eye-fork length measurement . (shown here on blue marlin).

The eye-fork length (EFL) will be measured in Group B species.

B. Collecting weekly length-frequency samples of the decked fish catch

A major objective of the sampling is to estimate the length composition of the decked catch of the key marine fish species. In order to provide for broad time-area coverage, length frequency sampling will be conducted in 7-day intervals during each designated observer's stay onboard a driftnet vessel. At a minimum, depending on availability of fish, each observer should measure the first 30 fish (insofar as feasible; the critical factor is that fish should not be selected by their size) of each designated species retrieved during each 7-day interval, beginning with the first day of

observation. Simply put, 30 length measurements for each designated species are to be taken every seven days.

Japanese Vessels

The agreement with Japan explicitly states that observers will collect routine length frequency samples from albacore and other tuna species on a weekly basis. It also explicitly states that observers will collect billfish length frequency data. The agreement with Japan is silent on routine length frequency sampling of other key fish species. Therefore, U.S. observers on Japanese vessels should collect the routine weekly length frequency data only from the following species:

- O albacore
- O yellowfin tuna
- O bluefin tuna
- O bigeye tuna
- O skipjack tuna
- O blue marlin
- O striped marlin
- O shortnose spearfish
- O swordfish

Korean and Taiwanese Vessels

U.S. observers deployed on Korean and Taiwanese vessels should collect routine length frequency data from all key species.

Depending upon the species, two types of length measurement will be utilized. Again, for the species listed in Group A, a "standard fork length" (FL) will be taken. The FL is a straight line measurement from the tip of the snout (upper jaw) to the posterior edge of the median caudal rays (Fig. 1). For the species listed in Group B (the billfishes and sharks), an "eye-fork length" (EFL) will be measured. The EFL is a straightline measurement from the posterior edge of the eye orbit to the posterior edge of the median caudal rays (Fig. 2). Again, for the ease of the observer, these figures illustrating the two measurements can be found on the reverse side of the length frequency form.

To facilitate the routine length-frequency sampling, the observer should monitor the cumulative number of measurements taken during each 7-day interval and be aware at the beginning of each monitored section retrieval of how many additional measurements are needed to complete the sampling requirements. The observer should then communicate to the sendo how many of the various species are needed. The fish for length sampling should be set aside by the crew, in whatever manner is most practical and acceptable to all concerned, and processed by the observer between section retrievals.

In the case of Group A fishes, the observer should use the plastic measuring and data recording board provided, and record a "hash mark" for each fish falling in a particular length interval (i.e., the interval whose lower bound and upper bound bracket the actual FL). The boards are marked in 1-cm increments. Hash marks and other notations on the plastic sampling board

should be made with a lead pencil. After the information is transferred to the standard "Driftnet Observer Fish Length Frequency Form" (see below) the board should be scrubbed clean. The observer will need to devise a "head board" against which the measuring board and snout of the fish to be measured can be squarely placed.

In the case of Group B fishes, the observer should use a flexible tape measure to measure EFL, placing the tape flush over the body of the fish. Measurements should be recorded to the next lowest 2 cm on the plastic data recording board or waterproof field book and later transferred to the standard length frequency sampling form.

C. The "Driftnet Observer Fish Length Frequency Form"

To facilitate monitoring the number of each fish species measured in each 7-day time interval, a standard data form was designed. It provides for measurements in blocks of 30 measurements during a particular 7-day period, with the observer identifying the species name and other particulars.

Length data should be transferred from the plastic measuring board or field book to the form in a cumulative fashion for each species. For Group A fishes, record length to the next lowest 1 cm (i.e., record the lower bound of the 1 cm FL interval). Similarly, for Group B fishes, record the next lowest 2 cm EFL. The minimum sampling requirement are completed for the particular 7-day period when the 30 spaces allocated for a given species are filled up. However, if sufficient time and fish are available to exceed the 30 fish minimum, the observer can complete additional 30-fish sections for that species. In any event, once a 7-day interval is finished, a new set of forms should be used, and the counts of sampled fish started over.

For each fish length measurement transferred to the form, the observed operation number (OPE#) and section number (SEC#) of the gillnet should also be indicated. For example, in the case of a schooling species such as pomfret, all 30 required measurements would likely be taken from fish caught in one section of gillnet. All of the OPE# and SEC# would thus be the same for each of the 30 fish and length frequency sampling for pomfret could be suspended until the next 7-day interval (unless time permitted additional pomfret measurements). In the case of species less commonly encountered, such as blue marlin, it may take the full 7-days to complete the 30 fish requirement and in fact the observer may not be able to achieve the desired number of measurements within the time interval.

A vessel will generally operate in the same area during a given 7-day interval. However, should fishing be interrupted by a decision to move the vessel to new fishing grounds, with transit involving a loss of 1 or more fishing days, then a new time interval for length sampling and recording should be started when fishing operations resume in the new area. The current length frequency forms should be concluded and summarized.

D. Size composition of marine fishes retained and discarded

The procedures outlined above for routine length frequency sampling of decked non-salmonid fishes will provide comprehensive coverage on a broad time/area basis. The regular weekly

sampling of length frequencies for decked fish will allow temporal and spatial variation in the size composition to be estimated.

In addition, for the species of high commercial value, in which a portion of the decked catch is kept and processed by the vessel, supplemental information is needed to determine:

(1) the size composition of those fish retained and processed, by species and type of processing, and

(2) the size composition of the portion of the catch of each species that is discarded.

To provide such estimates, supplemental length frequency sampling by observers is required during the course of a cruise, along with daily reporting by the vessel captain of the quantities of certain fish retained and discarded. As with the routine length sampling, the approach to this supplemental sampling may vary from fleet to fleet.

Japanese Vessels

The observer agreement with Japan stipulates that:

"on a daily basis the vessel captain will provide to the observer information on the quantities of albacore, billfishes, and sharks retained by the vessel and the quantities discarded. Information on the quantities retained by the vessel will be provided with respect to each processed form, including whole fish, fillets, loins, fins, and belly portions. In a manner not to interfere with efficient operations of the vessel, observers may collect data to determine the size composition of albacore discarded by the vessel, the size composition of those retained by the vessel, and the relative weights of whole fish and the various processed forms."

Accordingly, ALL observers on Japanese vessels should collect the data from the vessel captain regarding the quantities of albacore, billfishes (by species...blue marlin, striped marlin, shortnose spearfish, and swordfish), and sharks (by species ... salmon shark, blue shark, shortfin mako shark, thresher shark, etc.) retained by the vessel and the quantities discarded. They should collect similar data for other species of tuna if such data are available and the captain is willing to provide them. Data on retained catch should be collected for each category of on-board processing. A standard form for recording such information is provided (see attachment). The units of measurement for such reporting were not specified, but would preferably be both number of pieces and total weight (kgs) of each species for retained fish, and number of pieces of each species for discards.

Designated observers on Japanese vessels should, in addition, collect length frequency data from random samples of albacore that are discarded, and separate random samples from those albacore that are retained in various processed forms. These samples will be above and beyond the regular weekly length frequency samples to be completed for decked albacore. During the course of the cruise, the observer should measure fork length on 30 albacore selected at random from albacore processed in each form; 30 albacore representative of those discarded by the vessel should also be selected randomly and measured. To record these supplemental length data the observers may use the standard length frequency forms, but indicate on the form (1) that it is a supplemental sample,

(2) whether the sample is for discards or retained albacore, and (3) how the fish were to be processed (if retained).

Korean and Taiwanese Vessels

The observer agreement with Taiwan representatives specifies that:

"on a daily basis, the vessel captain will provide to the observer information on the quantities of albacore, other species of tuna, swordfish, marlin, and sharks retained by the host vessel and the quantities discarded. Information on the quantities retained retained by the vessel will be provided with respect to each processed form, including whole fish, fillets, loins, fins, and belly portions. In a manner not to interfere with the operation of the host vessel, observers may collect data to determine the size composition of albacore or other species discarded by the vessel, the size composition of those retained by the vessel, and the relative weights of whole fish and the various processed forms."

Accordingly, ALL observers on Taiwanese vessels should collect the data from the vessel captain regarding the quantities of albacore, other tuna (by species ...yellowfin tuna, bigeye tuna, bluefin tuna, skipjack), marlin (by species ...blue marlin, striped marlin, shortnose spearfish), swordfish, and sharks (by species ...salmon shark, blue shark, shortfin mako shark, thresher shark, etc.) retained by the vessel and the quantities discarded. They should also collect information on the quantities retained by processed form. A standard form for recording such information is provided. The units of measurement for such reporting were not specified, but would preferably be both number of pieces and total weight (kgs) of each species for retained fish, and number of pieces of each species for discards.

Designated observers on Taiwanese vessels should, in addition, collect length frequency data from random samples of albacore and the various species of other tuna, marlin, swordfish, and sharks that are discarded, and separate random samples for those members of these various species that are retained in various processed forms. These samples are above and beyond the regular weekly length frequency samples required for albacore. During the course of the cruise, the observer should measure fork length or eye-fork length, as appropriate, on 30 individuals selected at random from each separate category of fish. To record the supplemental length data the observers may use the standard length frequency forms, but indicate on the form (1) that it is a supplemental sample, (2) whether the sample is for discards or retained fish, and (3) how the fish were to be processed (if retained).

Regarding collection of data on disposition of catch and supplemental length frequency sampling, observers on Korean vessels should follow the same procedures as indicated for observers on Taiwanese vessels.

Sampling of very small albacore

There is a special need to collect samples of albacore with fork length less than 30 cm. Typically such small albacore would be discarded by the vessel. All U.S. observers on all vessels should keep samples of such small albacore, measure their fork length, place them whole in a

plastic whirl-pac bag, include a proper specimen label, and freeze them. A maximum of 10 such small albacore per observer per cruise would be sufficient (extra small albacore, such as those 20 cm or shorter, should be kept in any case).

Observers on Taiwanese vessels must be sure that the small albacore kept and frozen are taken from those that the vessel plans to discard.

Squid

Background

Although emphasis in the high-seas squid driftnet fishery observer program is focused on the incidental entanglement of fishes, marine mammals, seabirds, and sea turtles, there is also considerable interest in understanding the biology and population dynamics of the target species. Accordingly, observers deployed on some vessels should take advantage of opportunities to collect length frequency data from random samples of the squid catch. This will be done only on Korean vessels and on Taiwanese vessels whose captains agree to cooperate. Guidelines are presented below to assist in squid identification and length frequency sampling.

Mantle Length Measurements

Each designated U.S. observer on Korean and Taiwanese vessels should collect mantle length (ML) frequency data from random samples of the target species, the neon flying squid, Ommastrephes bartramii. To accomplish this, each day of observed operations the observers should non-selectively measure the ML of 30 flying squid landed from a single observed section. If the vessel is deploying more than one size of mesh, the observer should try to choose the section to be sampled each day in such a way that the various mesh sizes are evenly sampled during the course of the observer's stay on the vessel. A flexible tape should be used to take the measurements. The ML of a squid is the straight line measurement from anterior edge of the mantle to the tip of the tail. All length data should be collected in cm, accurate to the next lowest 1.0 cm.

To facilitate data recording, the "Driftnet Observer Squid Mantle Length Frequency Form" is provided. It has enough space allocated to accommodate the daily 30-squid sample requirement for three days worth of sampling. Measurements taken on the deck should be recorded in a waterproof field book, then transferred later to the printed data forms. The information on vessel name, observer name, section number, and mesh size should be filled in routinely for each sample.

APPENDIX

TABLE OF EQUIVALENTS

1 inch = 2.540 centimeters — 1 centimeter = .3937 inches
1 foot = .3048 meters — 1 meter = 3.2808 feet
1 foot = .1667 fathoms
1 fathom = 6 feet = 1.829 meters — 1 meter = 100 cm = 0.5468 fathoms

1 statute mile = 5280 feet = 1.609 kilometers = 0.86899 nautical miles
= 880 fathoms
1 nautical mile = 1.15078 statute miles = 1 minute of latitude
= 1.852 kilometers = 1012.6859 fathoms = 1852 meters
1 fathom = 0.0009875 nautical miles = 0.0011364 statute miles

1 pound = 0.4536 kg — 1 kg = 2.2046 lb.

total catch wt. in lbs ÷ 2.2046 = total catch wt. in kilograms

1 metric ton = 1000 kg = 2204.6 lbs = 0.9842 long tons = 1.1023 short tons
1 short ton = 907.1847 kg = 2000 lbs = 0.8929 long tons = 0.9072 metric tons
1 long ton (British) = 1016.0469 kg = 2240 lbs = 1.1060 metric tons
= 1.12 short tons

CONVERTING POUNDS TO METRIC TONS

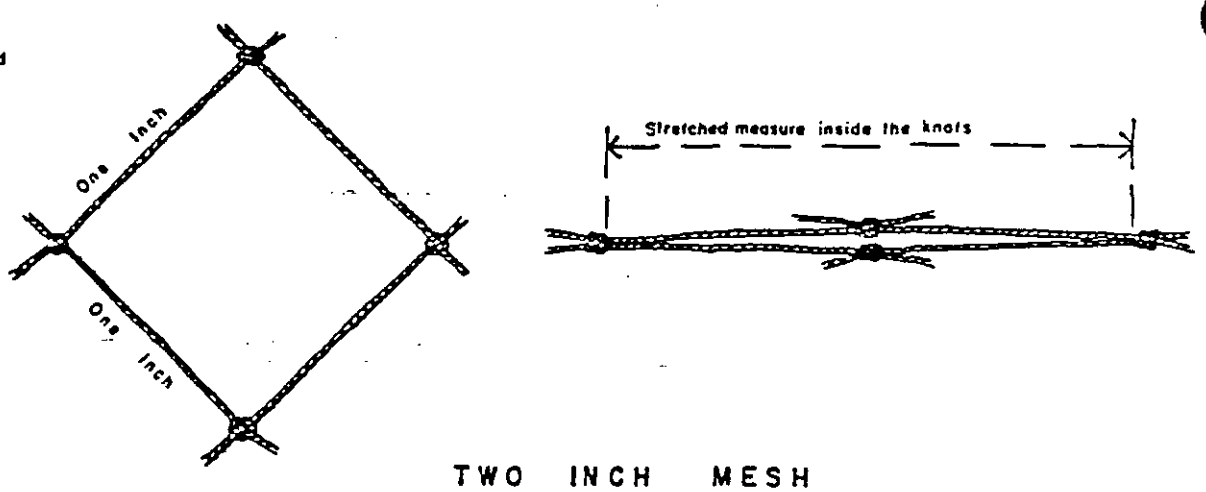
LBS	MT	LBS	MT
1000	0.4536	14000	6.3503
2000	0.9072	15000	6.8039
3000	1.3608	16000	7.2575
4000	1.8144	17000	7.7111
5000	2.2680	18000	8.1647
6000	2.7216	19000	8.6183
7000	3.1751	20000	9.0718
8000	3.6287	21000	9.5254
9000	4.0823	22000	9.9790
10000	4.5359	23000	10.4326
11000	4.9895	24000	10.8862
12000	5.4431	25000	11.3398
13000	5.8967	26000	11.7934

HOW TO MEASURE MESH SIZE

The mesh size measurement requested on the gear diagram is the stretched measure, that is, the distance between two diagonal knots when the mesh is tightly stretched (see second diagram below). In order to obtain this measurement, the net must be empty and the mesh pulled tightly enough so that two opposite knots of the mesh square meet and all four knots are in the same plane; measure the distance inside the two most distant knots in the mesh square.

An easier way of obtaining the same measurement (the net does not have to be empty) is to measure the distance between two adjacent knots in a mesh square (the side of a square) and multiply by two. Check several meshes in each part of the net.

W. L. Scofield



TWO INCH MESH

A two-inch mesh, open (left) and stretched. This points up variables inherent in web measure and consequent difficulties. Common yardstick is "stretch measure."

Appendix 3. Table of Sea Conditions (Beaufort Scale)

Knots	Wave ht. Description	Sea conditions	(Beaufort)	(ft.)
0- 1	Calm	Sea smooth and mirror-like	0	
1- 3	Light Air	Scale-like ripples without foam crests	1	
4- 6	Light breeze	Small, short wavelets; crests have a glassy appearance and do not break.	2	2
7-10	Gentle breeze	Large wavelets; some crests begin to break foam of glassy appearance. Occasional white foam crests.	3	2
11-16	Moderate breeze	Small waves, becoming longer; fairly frequent white foam crests.	4	4
17-21	Fresh breeze	Moderate waves, taking a more pronounced long form; many white foam crests; there may be some spray.	5	6
22-27	Strong breeze	Large waves begin to form; white foam crests are more extensive everywhere; there may be some spray.	6	10
28-33	Near gale	Sea heaps up and white form from breaking waves begins to be blown in streaks along the direction of the wind; spindrift begins.	7	14
34-40	Gale	Moderately high waves of greater length; edges of crests break into spindrift; foam is blown in well-marked streaks along the direction of the wind.	8	18
41-47	Strong gale	High waves; dense streaks of foam along the direction of the wind; crests of waves begin to topple, tumble, and roll over; spray may reduce visibility.	9	23

48-55	Storm	Very high waves with long overhanging crests. The resulting foam in great patches is blown in dense white streaks along the direction of the wind. On the whole, the surface of the sea is white in appearance. The tumbling of the sea becomes heavy and shocklike. Visibility is reduced.	10	29
56-63	Violent storm	Exceptionally high waves that may obscure small and medium-sized ships. The sea is completely covered with long white patches of foam lying along the direction of the wind. Everywhere the edges of the wave crests are blown into froth. Visibility reduced.	11	37
64-71	Hurricane	The air is filled with foam and spray. Sea completely white with driving spray; visibility very much reduced.	12	45

Appendix 4. Temperature Conversion Table.

Fahrenheit	Celcius
90	32.2
88	31.1
84	28.0
82	27.8
80	26.7
78	25.6
76	24.4
74	23.3
72	22.2
70	21.1
68	20.0
66	18.9
64	17.8
62	16.7
60	15.6
58	14.4
56	13.3
54	12.2
52	11.1
50	10.0
48	8.9
46	7.8
44	6.7
42	5.6
40	4.4
38	
36	
34	
32	0.0
30	1.1
28	-2.2
26	-3.3

Appendix 5. Procedures for use of Fujinon 7x50 binoculars.

The Fujinon binoculars contain reticles and compasses which are used to estimate the distance and angle to animals at the time of the initial sighting.

Calibration

1. Record the height in meters from the water line to your eye on the sighting platform (e.g., flying bridge). This only needs to be done once if you always use the same platform. This height will be used in converting the reticle number to distance.
2. At the beginning of each sighting period or transect leg, record the compass reading dead ahead from the location where you are doing sightings. This will be used to calculate the sighting angle.

Distance Measurement

When an animal is sighted, find the animals with the binoculars, and place the top horizontal line (reticle) on the horizon, then count the number of reticles down to the animal's waterline (the first reticle on the horizon is defined as zero). Every second reticle is longer so that you can count by twos. If the animals are close, it will be better to count up from the bottom (there are sixteen reticles counting the top one as zero, and the bottom line of vision as sixteen). Also note the compass reading (this will be used to calculate the sighting angle). Of course this will all need to be done simultaneously with identification of species, estimation of group size, and noting the behavior.

Table 1 shows the conversion for a reticle number to meters given the height of the eye above the water. Record the number of reticles on the sighting form, then convert the number of reticles to sighting distance in meters using the table. Round off to the nearest tens of meters and write the sighting distance in the appropriate box.

Angle Estimation

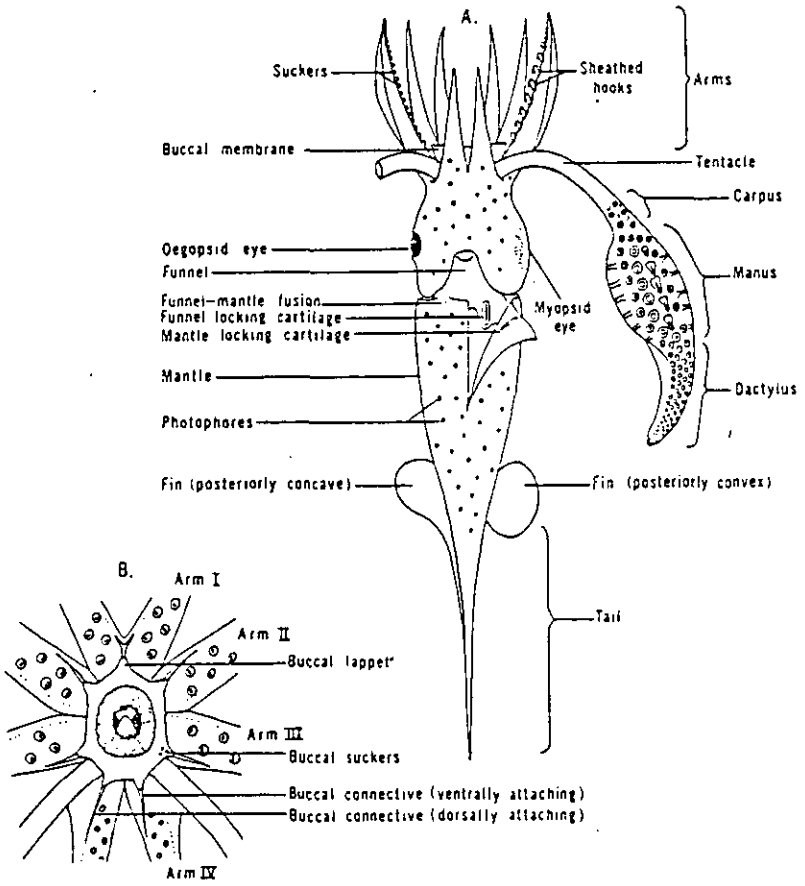
The sighting angle is estimated by: sighting angle = (360) - (difference between recorded degrees and degrees dead ahead).

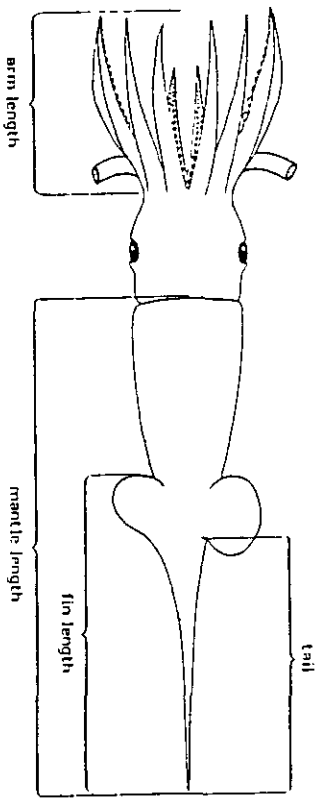
For example, if dead ahead is at 350 degrees, and a sighting is seen at 30 degrees (this is to starboard), then the sighting angle is 40 degrees, difference between recorded degrees and degrees straight ahead: 70-40=30.
Port: 360- Difference = 360-30=330° (360-350=10, and 10+30=40). If dead ahead is at 70 degrees and the recorded degrees is 40 (port), then the sighting angle is 330 degrees. Starboard: 30-350= -320, 360-320= 40°. Remember degrees increase in a clockwise direction from 0 to 360.

Table 1. Conversion of number of reticles (down from the horizon) to sighting distances in meters for several heights above water level for use with Fujinon binoculars.

Record the number of reticles as well as the converted distance on the sighting form.

No. of reticles	Height of eye above water level (in meters).															
	4	4.5	5	5.5	6	6.5	7	7.5	8	8.5	9	9.5	10	10.5	11.0	11.5
0	7675	8141	8581	9000	9400	9784	10153	10510	10854	11188	11513	11828	12136	12435	12728	13014
0.5	1344	1496	1646	1794	1940	2084	2226	2367	2506	2644	2781	2916	3050	3183	3314	3445
1	737	824	910	996	1081	1166	1250	1334	1417	1499	1581	1663	1744	1825	1905	1985
1.5	507	568	629	690	750	810	869	928	987	1046	1105	1163	1221	1279	1337	1394
2	387	434	481	527	574	620	666	712	758	803	849	894	940	985	1030	1074
2.5	313	351	389	427	465	502	540	577	615	652	689	726	763	800	837	874
3	262	294	327	359	390	422	454	486	517	549	580	612	642	674	705	737
3.5	226	254	281	309	337	364	392	419	446	474	500	528	555	582	609	636
4	198	223	247	272	296	320	344	368	393	417	441	465	489	513	536	560
4.5	177	199	220	242	264	286	307	329	350	372	393	415	436	458	479	500
5	160	179	199	219	238	258	277	297	316	336	355	375	394	413	433	452
5.5	145	163	181	199	217	235	253	271	288	306	324	342	359	377	395	412
6	133	150	166	183	199	216	232	249	265	281	300	314	330	346	363	379
7	115	129	143	157	171	185	200	214	228	242	256	270	284	298	312	326
8	100	113	125	138	150	163	175	187	200	212	225	237	249	262	274	286
9	89	101	112	123	134	145	156	167	178	189	200	211	222	233	244	255
10	81	91	101	111	121	131	140	150	160	170	180	190	200	210	220	230
11	73	82	92	101	110	119	128	137	146	155	164	173	182	191	200	209
12	67	76	84	92	101	109	117	126	134	142	151	159	167	175	184	192
13	62	70	78	85	93	101	108	116	124	131	139	147	154	162	170	177
14	58	65	72	79	86	94	101	108	115	122	129	136	144	151	158	165
15	54	61	67	74	80	87	94	101	108	114	121	127	134	141	147	154
16	50	57	63	69	76	82	88	94	101	107	113	119	125	132	138	144


A.
Suckers
Sheathed hooks
Arms
Buccal membrane
Tentacle
Carpus
Oegopsid eye
Funnel
Manus
Funnel–mantle fusion
Funnel locking cartilage
Mantle locking cartilage
Myopsid eye
Mantle
Dactylus
Photophores
Fin (posteriorly concave)
Fin (posteriorly convex)
Tail
B.
Arm I
Arm II
Buccal lappet
Arm III
Buccal suckers
Buccal connective (ventrally attaching)
Buccal connective (dorsally attaching)
Arm IV


arm length
mantle length
fin length
tail

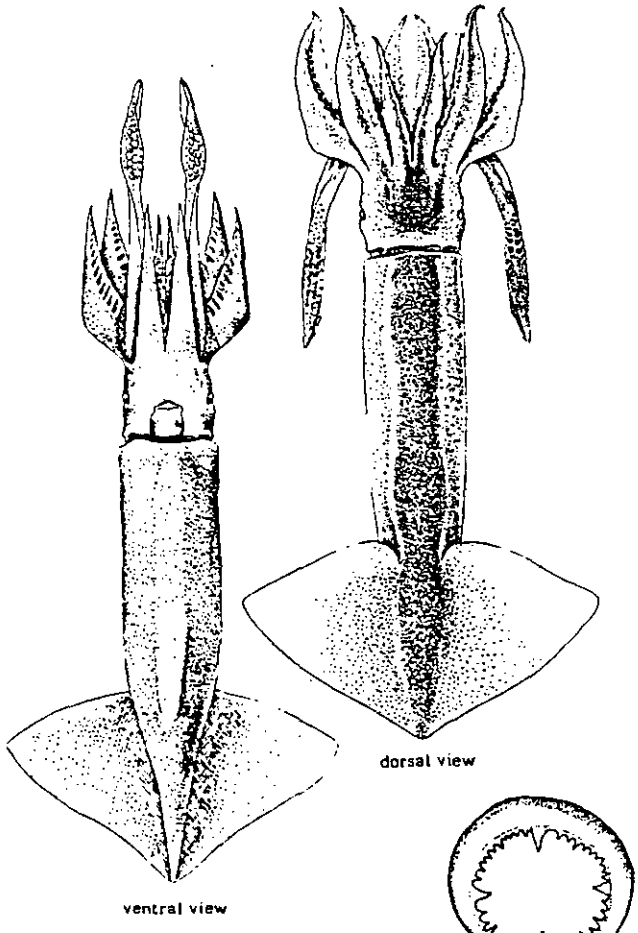
NEON FLYING SQUID

SCIENTIFIC NAME: Ommastrephes bartramii (Lesueur, 1821)
JAPANESE NAME: "aka-ika"
FAMILY: Ommastrephidae

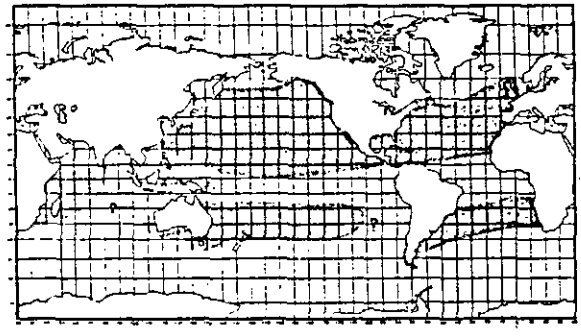
DESCRIPTION: The neon flying squid is the target species of the North Pacific small mesh drift gillnet fishery. Typical of oceanic ommastrephid squids, this large species possesses a very muscular, robust mantle that tapers into the conical tail. The fins, which are also muscular, occupy 40 to 45% of the mantle length and are sagittate in outline. Ommastrephes bartrami can readily be distinguished from other ommastrephids by the presence of a long golden or silvery luminescent organ along the ventral midline from mantle opening to the level of fin insertion. Also characteristic of ommastrephids are the inverted T-shaped funnel locking cartilage.

Also distinctive of the species are four equidistant enlarged teeth in each of the largest tentacular sucker rings. Four to six small suckers are present on the tentacular stalk priximal to the first smooth knob of the fixing apparatus.

Female flying squid will attain 50 cm ML, becoming sexually mature at about 40 cm ML. Males are somewhat smaller.



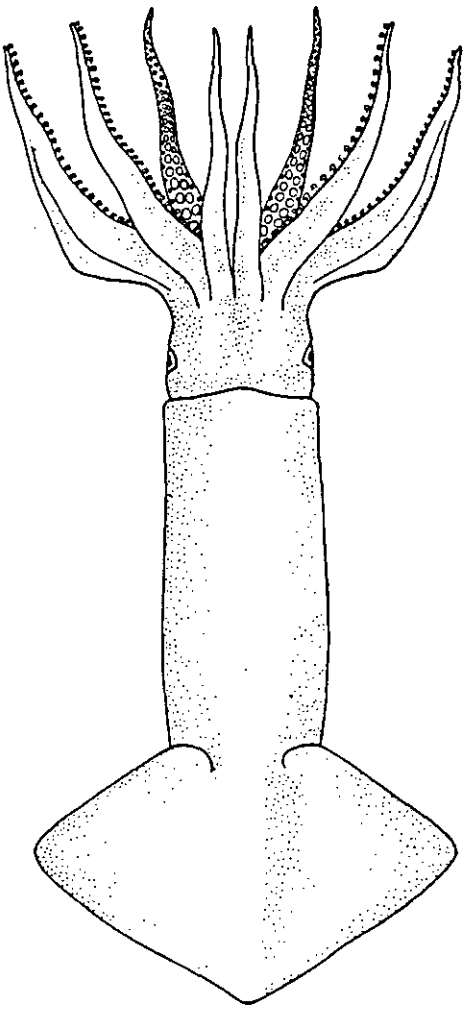
DISTRIBUTION: Ommastrephes bartramii occurs worldwide in subtropical and temperate oceanic waters. Vertically, the species is believed to occupy the water column from the surface to approximately 1,500 m depth. In the North Pacific, it is generally understood that flying squid undergo seasonal migrations from the "feeding" grounds in northern waters (primarily between 36° and 46°N latitude) between July and December to the subtropics bounded by about 20° and 35°N latitude where they presumably spawn between late February and May.



BOREOPACIFIC GONATE SQUID

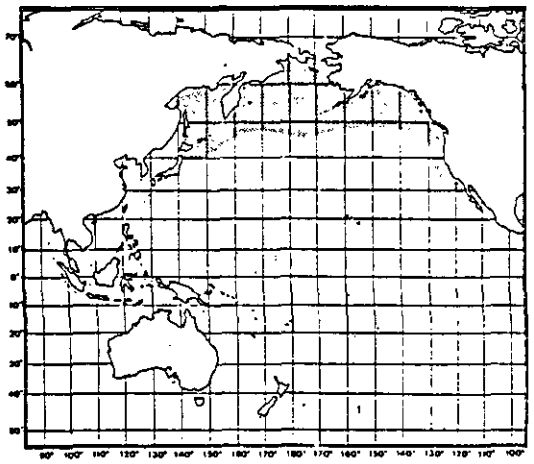
SCIENTIFIC NAME: Gonatopsis borealis Sasaki, 1923
JAPANESE NAME: "tako-ika"
FAMILY: Gonatidae

DESCRIPTION: Gonatopsis borealis can be differentiated from the other species profiled here by the absence of tentacles. The eight arms are robust and muscular, unequal in length, and with the exception of arm IV, are equipped with rows of hooks. The mantle is thick and stout; the relatively short sagittate fins extend about 40-45% of the mantle length. It is believed that the species grows in excess of the reported maximum mantle length of 30 cm.



dorsal view

DISTRIBUTION: This oceanic squid is found in cold, temperate waters of the North Pacific. A vertically migrating species, G. borealis occupies depths to 700 m and are know to form large aggregations.



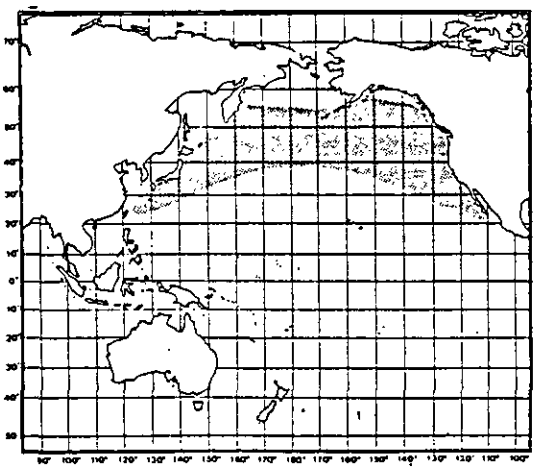
BOREAL CLUBHOOK SQUID

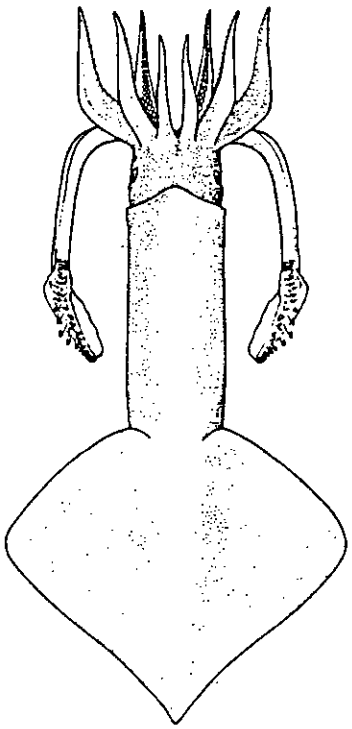
SCIENTIFIC NAME: Onychoteuthis borealijaponica Okada, 1927
JAPANESE NAME: "tsumei-ika"
FAMILY: Onychoteuthidae

DESCRIPTION: The boreal clubhook squid has a long, slender, cylindrical mantle with broad fins occupying 55-60% of the mantle length. The mid-dorsal line exhibits the dorsal axis of the gladius. Diagnostic features of this species include the large number of hooks (25-27 in two rows) present on the tentacular clubs and the small oval photophores on the intestinal tract.

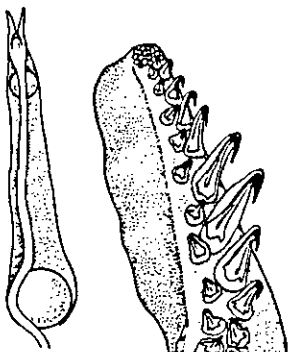
The maximum mantle length is reportedly 37 cm in females and 30 cm in males.

DISTRIBUTION: This epipelagic species occurs *in colder waters of the North Pacific.* The distribution of Onychoteuthis borealijaponica and its congener O. banksii are complementary.





dorsal view



photophores on intestinal tract ventral view

tentacular club

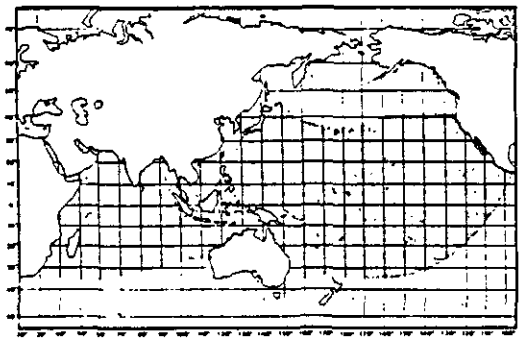
PURPLEBACK FLYING SQUID

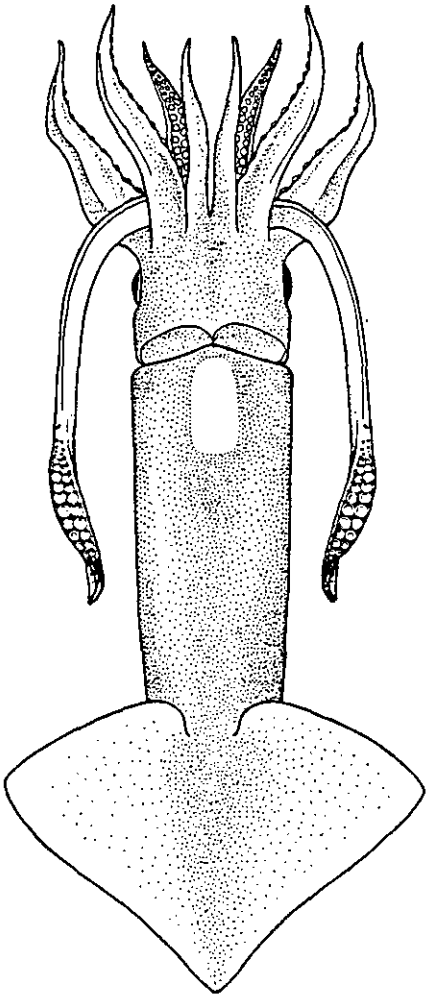
SCIENTIFIC NAME: Stenoteuthis oualaniensis (Lesson, 1830)
JAPANESE NAME: "tobi-ika"
FAMILY: Ommastrephidae

DESCRIPTION: The purpleback flying squid shares the very muscular mantle, conical tail, and sagittate fins characteristic of the neon flying squid. This species, however, can readily be distinguised from O. bartramii by the large, oval luminescent patch on the median anterodorsal surface of the mantle and by the fusion of the mantle and funnel at the inverted T-shaped locking cartilages.

In comparison to the neon flying squid, Stenoteuthis oualaniensis is a considerably smaller species attaining a maximum mantle length of about 35 cm.

DISTRIBUTION: The purpleback flying squid is an oceanic species occurring from the surface to about 1,000 m in depth in all subtropical and tropical waters of the Indo-Pacific region.





dorsal view

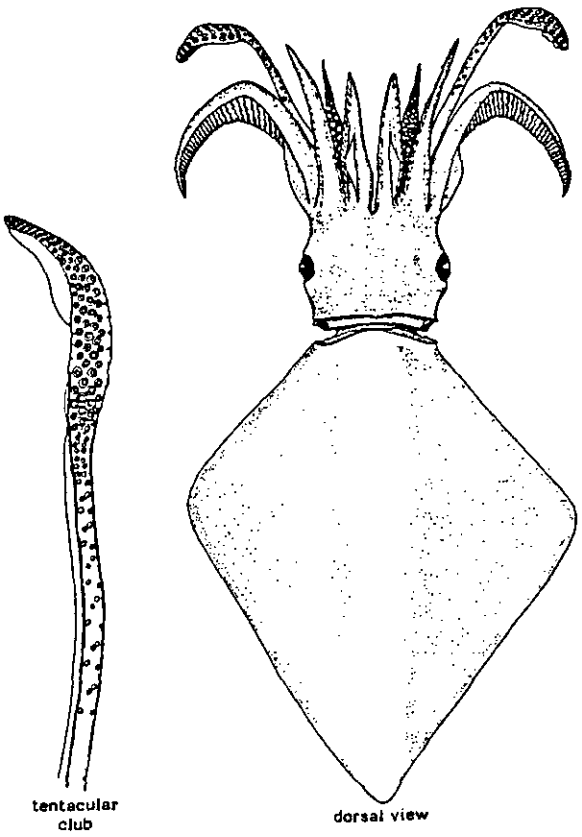
DIAMONDBACK SQUID

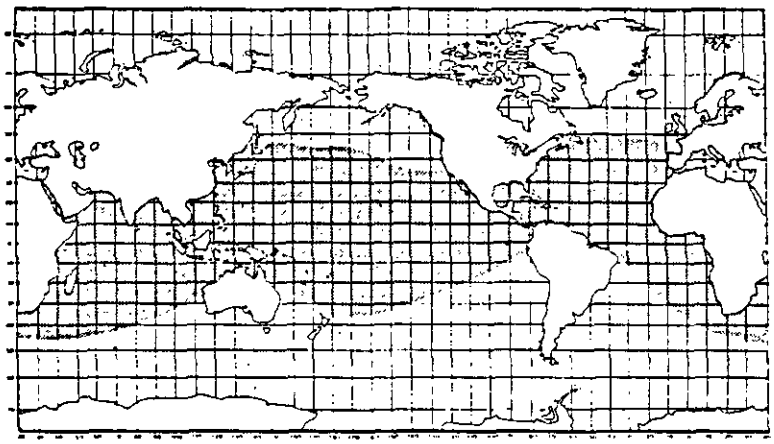
SCIENTIFIC NAME: Thysanoteuthis rhombus Troschel, 1857
JAPANESE NAME: "sodei-ika", "taru-ika", or "ootobi-ika"
FAMILY: Thysanoteuthidae

DESCRIPTION: Long, broad, rhomboid shaped fins that occupy the entire length of the mantle make this very large squid quite distinctive. The thick, muscular mantle of the diamondback squid tapers to a blunt tip posteriorly. The tentacular clubs and arms have 4 rows and 2 rows of suckers respectively.

Commonly taken up to 60 cm ML, the maximum mantle length is believed to be about 100 cm.

DISTRIBUTION: The horizontal and vertical distribution of this species is not well known. Presumably, Thysanoteuthis rhombus occurs worldwide in warm and warm temperate seas. These oceanic squid are known to occur in pairs or in small schools at the surface.



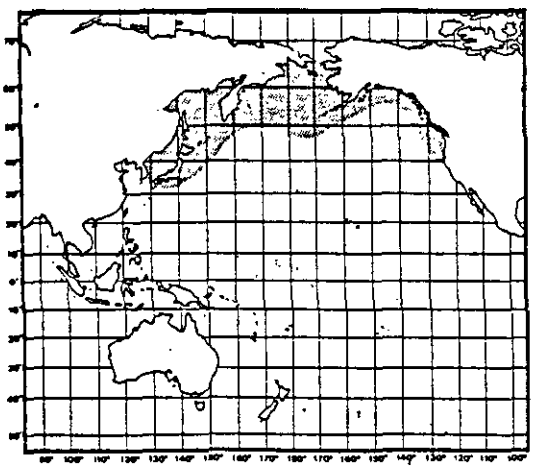


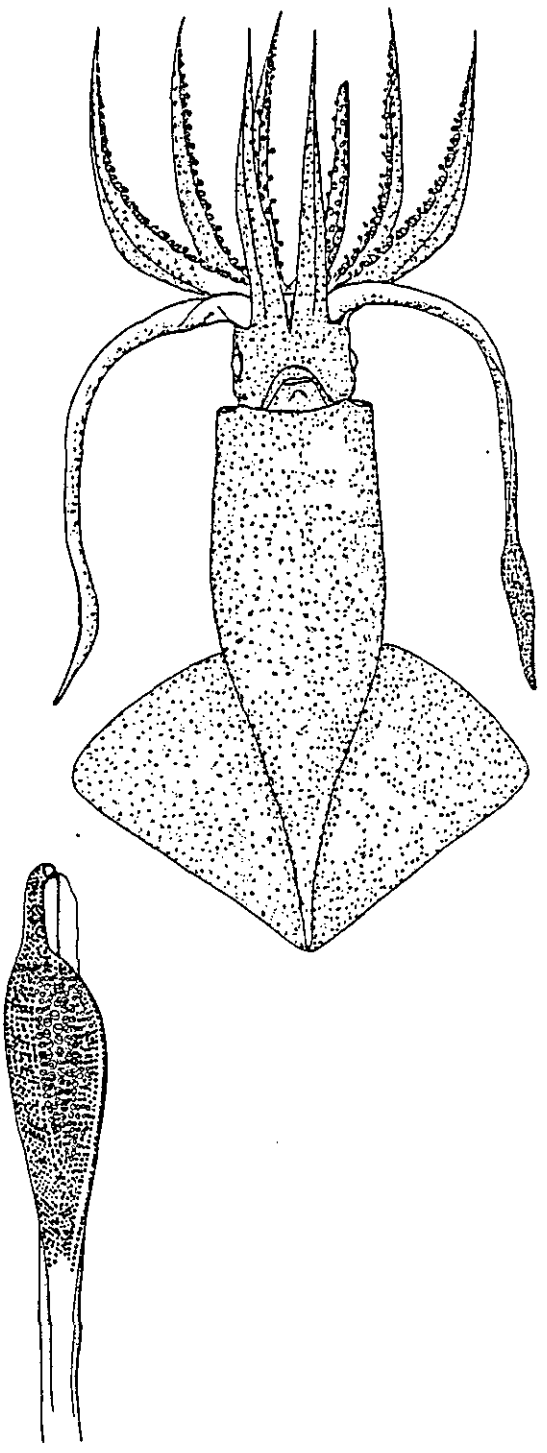
SCHOOLMASTER GONATE SQUID

SCIENTIFIC NAME: Berryteuthis magister (Berry, 1913)
JAPANESE NAME: "dosu-ika"
FAMILY: Gonatidae

DESCRIPTION: Berryteuthis magister, like other gonatid squids are characterized by the tetraserial armature on the arms of which the two medial rows on arms I to III are equipped with hooks. Unlike the related Gonatopsis borealis, B. magister possess' long tentacles and characteristic of the genus, lacks hooks on the tentacular club. The mantle is large and robust, but soft; the relatively long sagittate fins extend up to about 55% of the mantle length. The schoolmaster gonate squid will attain a maximum mantle length of 25 cm ML.

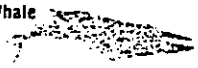
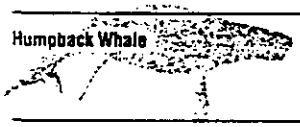
DISTRIBUTION: This oceanic squid is found in cold, temperate waters of the North Pacific. A neritic to oceanic species, B. magister have been recorded from the surface to about 1,000 m depth; adults are reportedly bottom associated.





tentacular club

Marine Mammal Life History Notes

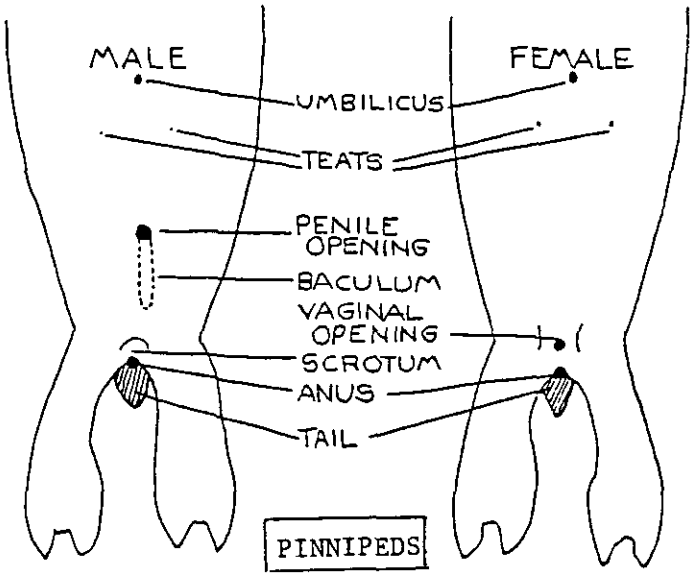
	Adult Length/Weight		Newborn Length/Weight		Life Span	Age at Sexual Maturity	Breeding and Reproduction	Characteristic Color
	m	kg	m	kg	yrs.	yrs.		
Harbor Seal 	1.8 ♂ 1.2 ♀	105 45	0.8	10	30	6 ♂ 6 ♀	Monogamous; Gestation 8-9 mos. delayed implantation, 2-3 mos.; 1 birth/year	Gray-brown with dark rings and spots. Dark brown at birth.
Elephant Seal 	5.0 ♂ 3.0 ♀	2,000 800	1.2	25	20	7-10 ♂ 3-4 ♀	Polygynous; Breed in California-Mexico, December-February; Gestation 11 mos.; 1 birth/year	Brown. Black at birth changing to gray in first month.
Northern Sea Lion 	3.2 ♂ 2.2 ♀	1,000 300		20	20	5 ♂ 3-5 ♀	Polygynous; Breed in North Pacific Islands, May-July; Gestation 11 mos. delayed implantation, 3.5 mos.; 1 birth/year	Dark brown at birth changing to tan by autumn
California Sea Lion 	2.5 ♂ 1.6 ♀	365 115	0.8	10	20	5 ♂ 5 ♀	Polygynous; Breed in California-Mexico, May-June; Gestation 11 mos.; 1 birth/year	Dark brown
Minke Whale 	9.0 ♂ 9.0 ♀	9,000 9,000	2.8	250		8 ♂ 8 ♀	Breed June-August. Gestation 10 mos.; 1 birth/year	Black with gray streaks, white shoulder band.
Humpback Whale 	16.0 ♂ 16.5 ♀	60,000 62,000	4.3	800	30-50	8 ♂ 8-9 ♀	Breed off Hawaii and Mexico, January-February; Gestation 11 mos.; 1 birth every 2-3 years	Black with white belly, often with extensive white on flippers.
Gray Whale 	13.0 ♂ 14.0 ♀	30,000 32,000	4.5	500	30-70	8 ♂ 8 ♀	Breed off Baja California, January-February; Gestation 13.5 mos.; 1 birth every 2-3 years	Gray with white and yellow patches of barnacles and whale lice
Killer Whale 	9.1 ♂ 8.2 ♀	5,000 3,000	2.4	180	40 +	9 ♂ 8 ♀	Gestation 15 mos.; 1 birth every 3 years	Black with white belly, eye patch, and flanks, and gray saddle behind dorsal fin
Pacific White-sided Dolphin 	2.2 ♂ 2.2 ♀	90 90	1.2	25		5 ♂ 5 ♀	Breed spring-fall; Gestation 10-12 mos.	Black with white streaks, shoulder, and belly
Short-finned Pilot Whale 	6.9 ♂ 5.0 ♀	1,200 800	1.4		40-50	12 ♂ 6 ♀	Breed year round; Gestation 14.5 mos.; 1 birth every 3 years	Black with gravish saddle and white patch on belly
Risso's Dolphin 	4.0 ♂ 4.0 ♀	500 500					Breeding/reproduction information unknown	Dark gray with white spots and patches
Harbor Porpoise 	*1.8 ♂* 1.8 ♀	*72* *72*	*0.8*	*10*		*3-4 ♂* 3-4 ♀	*Gestation 11 mos.; 1 birth/year*	*Gray to black backs with white bellies*
Dall's Porpoise 	2.0 ♂ 1.9 ♀	150 150	1.0	16	22 +	8 ♂ 7 ♀	Gestation 11 mos.; 1 birth every 3 years	Jet black with white patch on flanks

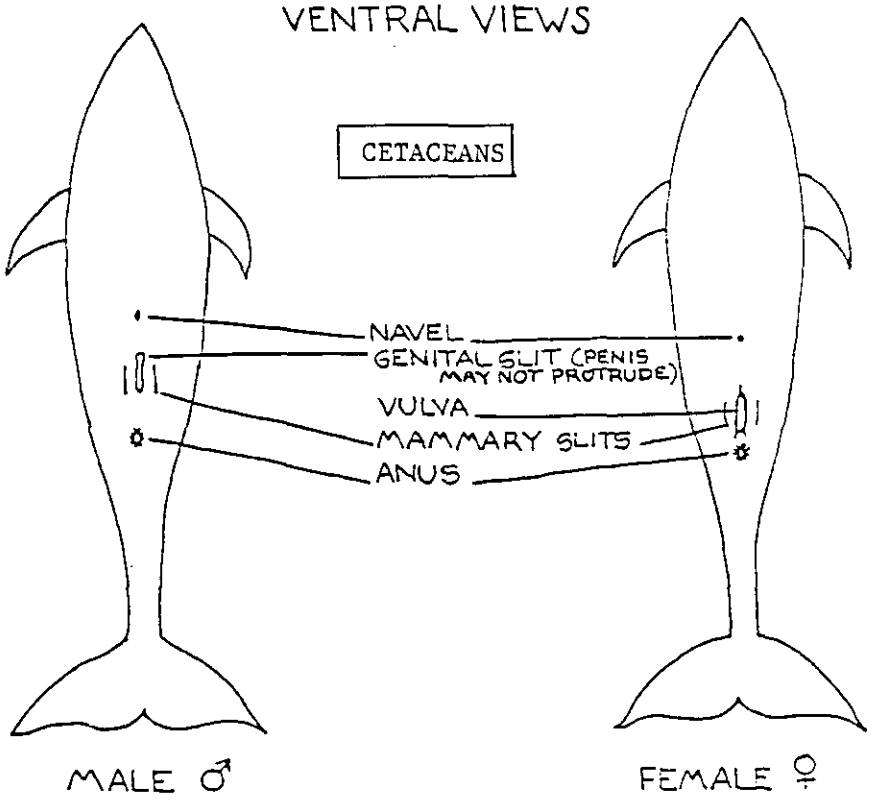
From: Birds and Mammals of Puget Sound by Angell & Balcomb

Table 1.—*Blowing and diving characteristics of some of the large whales (reproduced by permission from Gordon C. Pike,* Guide to the Whales, Porpoises and Dolphins of the North-East Pacific and Arctic Waters of Canada and Alaska)

Surfacing and blowing	Beginning the dive	Diving
	Blue 	
	Finback 	
	Sei 	
	Humpback 	
	Gray 	
	Right 	
	Sperm 	

SOME MORPHOLOGICAL DIFFERENCES BETWEEN MALE AND FEMALE PINNIPEDS AND CETACEANS



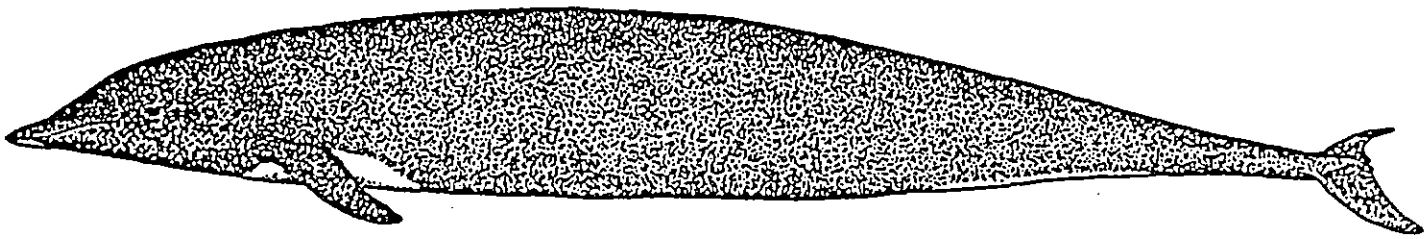


THE DISTANCE BETWEEN THE ANUS AND THE GENITALS IS GREATER IN MALES; OTHERWISE THE SEXES APPEAR SIMILAR BECAUSE MALES HAVE EXTERNAL TEATS, AND FEMALES HAVE ENLARGED CLITORI. IF POSSIBLE, TAKE A PHOTOGRAPH OR MAKE A DRAWING.

TRUE SEALS	*SEA LIONS/FUR SEALS*
No external ears	*External ears*
Small foreflippers for guidance only	*Large foreflippers - 1/4 of body length; used for power, guidance, walking*
Flippers fully furred	*Flippers partially furred*
Hind flippers cannot be turned under body	*Hindflippers long, can be turned under body*
Five claws on all flippers	*No claws on foreflippers, three on hindflippers*
Pelage varies in color	*Pelage uniformly colored*
Whiskers beaded	*Whiskers uniform*
Testes internal	*Testes scrotal*

NORTHERN RIGHT WHALE DOLPHIN

LISSODELPHIS BOREALIS



LENGTH Maximum length of adult males is 3.0 m, females to 2.3 m. At birth from 80-100 cm.

BODY SHAPE Long and slender, tapered anteriorly and posteriorly. The extremely narrow tail stock has no keel.

DORSAL FIN None--the only small cetacean in the North pacific without a dorsal fin.

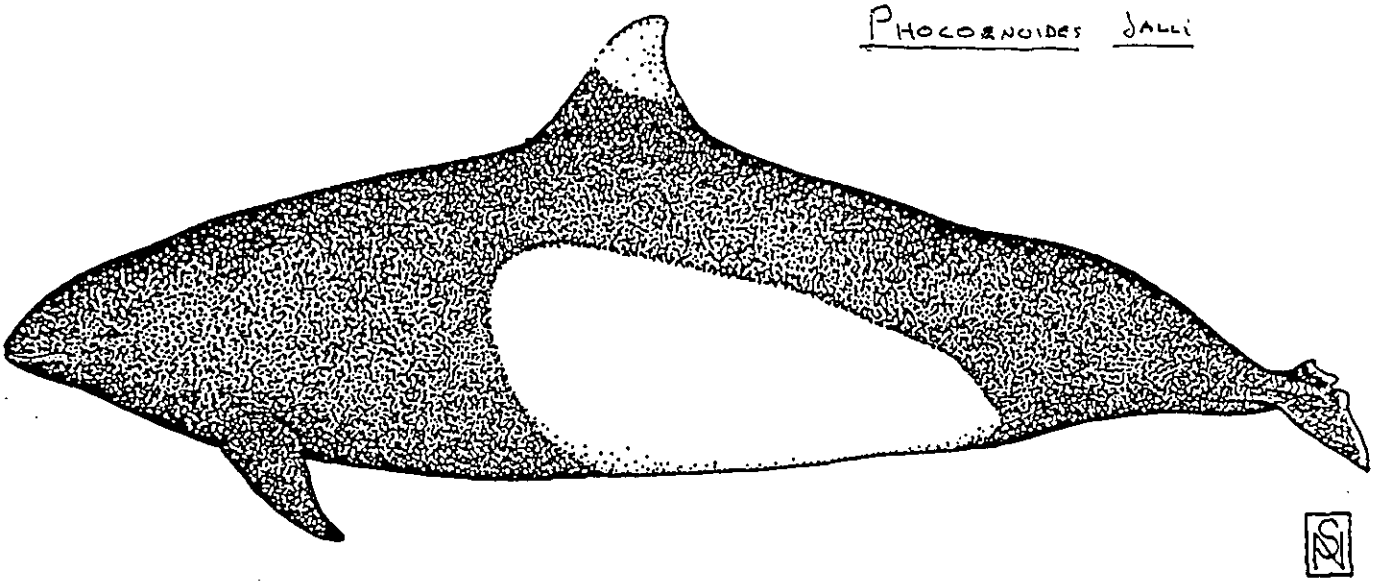
SNOUT/BEAK Virtually no forehead or chin. Short beak is very indistinctly set off by a faint area above the mouth. Has a white tip on the end of the lower jaw.

COLOR PATTERN Body is all black on back and sides; variable white pattern ventrally. This white extends from the tail to the head, with a widening in the thoracic area. Calves are much lighter, cream to light gray.

BEHAVIOR Gregarious--seen in herds of more than 100 animals. Often mixes with Pacific white-sided dolphins. Not usually found in waters warmer than 19°C.

DALL'S PORPOISE

PHOCOENOIDES DALLI



LENGTH To 2.2 m. Newborns are approximately 1 m long.

BODY SHAPE Extremely robust body with tiny head and small flukes and flippers. The tail stock has a pronounced keel, exaggerated in adult males.

DORSAL FIN Variable in shape, basically low and triangular with a long base. Usually bicolored, dark on lower forward half and white on upper trailing half.

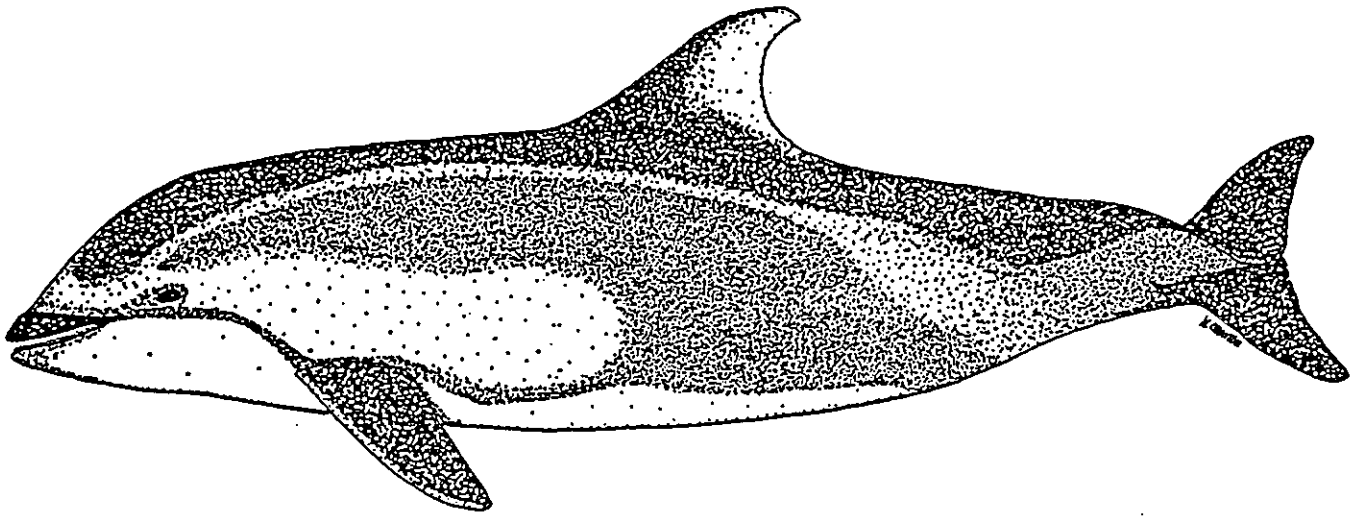
SNOUT/BEAK Forehead slopes steeply to a short poorly defined beak.

COLOR PATTERN Striking black and white pattern is very distinctive. Shiny black body with a large, conspicuous oval white patch at each side. White flank patch begins below dorsal fin in the dalli color type (pictured here), but extends anteriorly to the head in the truei color pattern. Some all black individuals have also been observed.

BEHAVIOR Small bands, usually with only 2-20. Sometimes seen with Pacific white-sided dolphins. Exhibit the distinctive "roostertail" -like splash when surfacing. Almost never porpoises.

PACIFIC WHITE-SIDED DOLPHIN

Lagenorhynchus obliquidens



LENGTH To at least 2.3 m. Length at birth is 80-95 cm.

BODY SHAPE Chunky, not as robust as Dall's porpoise but heavier-set than striped or common dolphins.

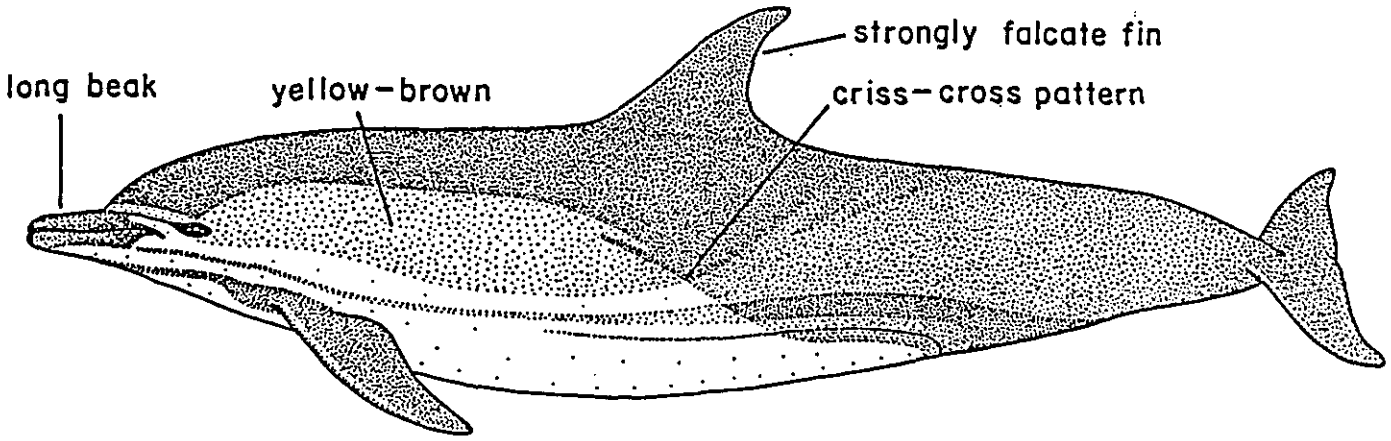
DORSAL FIN tall and strongly recurved, long base, located at mid-back. Dorsal fin has a dark leading edge, the latter 2/3 being white; gives the appearance of a "hook-fin".

SNOUT/BEAK Head tapers continuously and smoothly, dolphin has only a very abbreviated beak.

COLOR PATTERN Complex. Black back, light gray sides, and white belly. The black back is interrupted on each side of the dorsal fin by a light gray stripe beginning at forehead, curving up and over the head and back, then widening and curving down to the anal area. These stripes are known as "suspenders". The color pattern is highly variable.

BEHAVIOR extremely gregarious, occurring in herds up to several thousand. Groups of less than 200 are more common. A temperate water species.

COMMON DOLPHIN
Delphinus delphis



LENGTH Maximum length to about 2.5 m, most individuals less than 2.3 m. Length at birth approximately 80 cm.

BODY SHAPE Cylindrical, similar to striped dolphin.

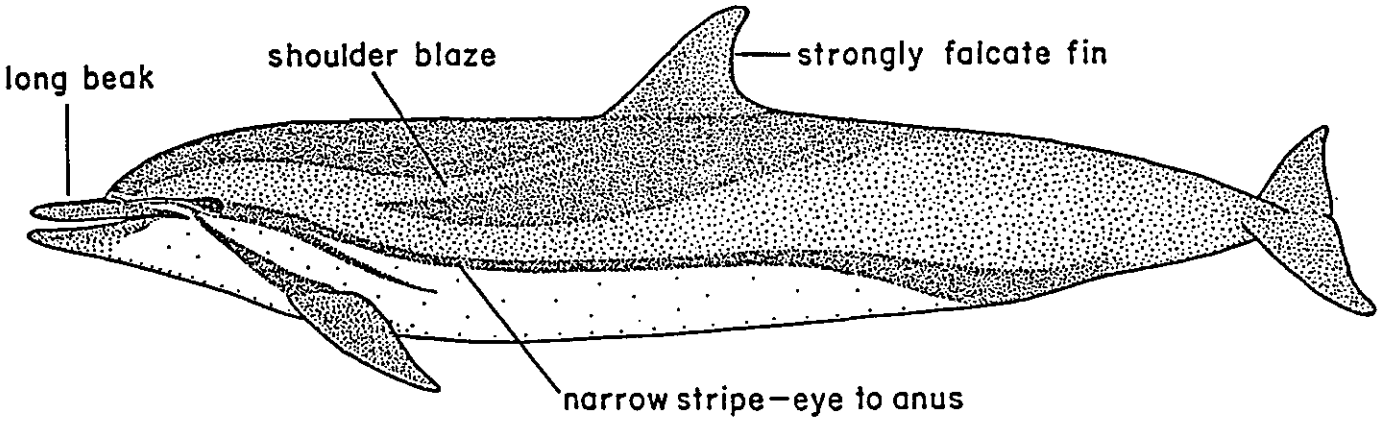
DORSAL FIN Tall, situated near middle of back. Varies in shape from nearly triangular to distinctly falcate. Pointed. Ranges from all black to light gray with a black border.

SNOUT/BEAK Long well defined beak; often black with a white tip.

COLOR PATTERN Four-part color pattern defined by a criss-cross. Black back, white belly, overlap of cape by ventral field is tan or yellowish-tan, area behind the cape is gray. Unique pattern gives impression of a V-shaped notch below the dorsal fin.

BEHAVIOR Gregarious--occurs in herds up to a thousand or more. Prefers water temperatures from 10°-28° C.

STRIPED DOLPHIN
Stenella coeruleoalba



LENGTH Adults are 1.9-2.3 m, newborns are approximately 1 m.

BODY SHAPE Cylindrical.

DORSAL FIN Falcate, dark, located at mid-back.

SNOUT/BEAK Long sharply defined beak.

COLOR PATTERN Distinctive. Top of the head and the back are dark gray to bluish gray, sides are a lighter gray, belly and throat white. Each side has two black stripes; one extending from eye to anus, the other from the eye to the flipper. The flank-stripe generally has a short inferior branch that ends above and behind the flipper, the eye to flipper stripe is often double.

A distinctive light blaze extends up and back from the lateral field into the cape toward the dorsal fin. This blaze is a good diagnostic feature.

BEHAVIOR Gregarious. Usually encountered in herds of several hundred.

MARINE BIRDS

Identification of marine bird species entangled in the net is very important and must be accurate. Work hard to identified each individual to species but do not guess! If you are not sure, list the highest level taxon of which you can be sure, e.g., unidentified albatross. When possible, document your identifications on a supplemental data sheet (see supplementary data section). Collecting the specimen is the best form of documentation. Bird identification takes practice and involves being able to recognize key characters and assemble them to form a composite picture that fits only one species. Knowledge of groups of species which are easily confused with each other is important. Key characters, e.g., size and shape of bill, differ between species and the observer needs to be familiar with most of them. Small details, e.g., color of feet, are often important. To compound the problem, great variation sometimes exists between individuals within the same species, e.g., light and dark color phases or geographic variation in size. Also, there may be differences between males and females, young and old birds, and birds in fresh plumage versus birds in worn and faded plumage.

Marine bird species that are most often caught by squid driftnets include: sooty shearwater, short-tailed shearwater, Laysan albatross, black-footed albatross, pale-footed shearwater, Buller's shearwater, northern fulmar, Leach's storm-petrel, fork-tailed storm-petrel, tufted puffin and horned puffin. Other marine bird species known to be caught in squid drift nets include: black-browed albatross, mottled petrel, providence petrel, white-necked petrel, streaked shearwater, pink-footed shearwater, south polar skua, pomarine jaeger, long-tailed jaeger, black-legged kittiwake, thick-billed murre, and ancient murrelet.

Marine birds can be difficult to identify because plumage patterns of black, white and brown predominate, and other colors are rare or not very prominant. Size is extremely variable and difficult to judge. Size can, however, be very useful if it can be compared against a known standard, e.g., human body parts, mesh size of net or a nearby recognizable species (Fig. 2). For free flying birds, behavior can be an important character. The principal characters you need to assess at first glance are:

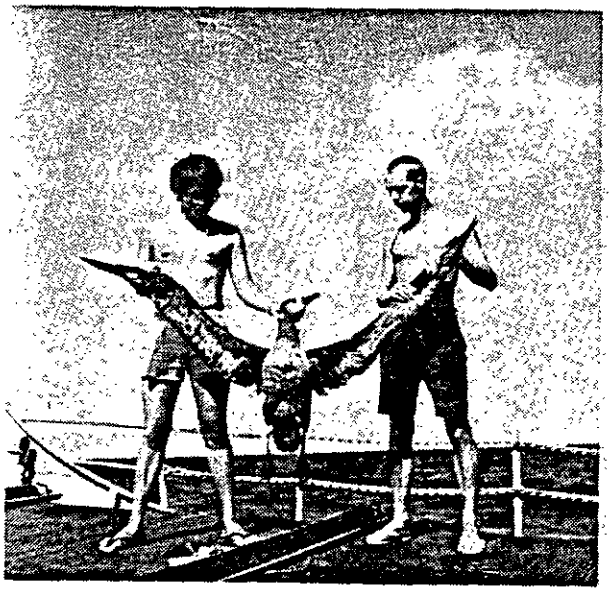
1. Plumage Pattern: solid color, solid color with patches, patterned light and dark (often dark above and light below). Note differences between head, back, belly, rump and tail. The underwing pattern is frequently helpful in distinguishing between species of marine birds.

2. Color: Dark, light, black, grey, brown, white.

3. Size and Shape of Bill (size of bill can be gaged by comparing it to head size of the bird: e.g., bill longer than head is wide).

4. Size and shape of body, wings and tail: wings or tail rounded, pointed or forked, short neck or long neck, etc.

5. Color of bill and feet.



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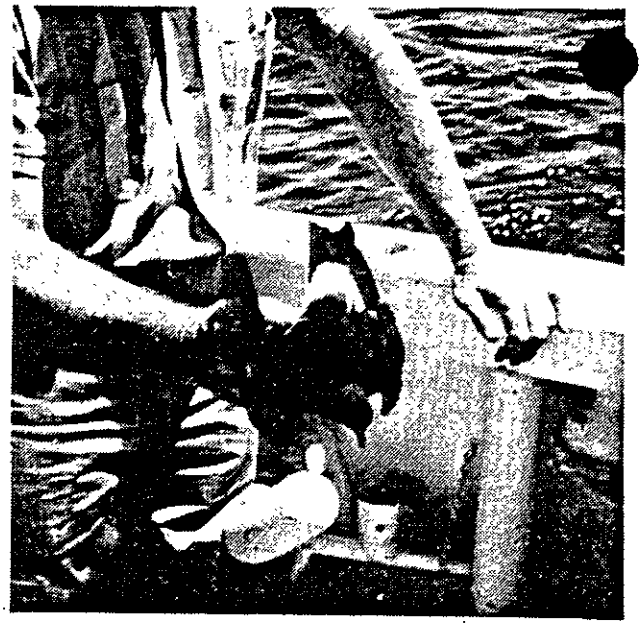


B

C

Figure 2.--Relative sizes of marine birds: A (black-footed albatross) = large; B (dark-rumped petrel) = medium; C (band-rumped storm-petrel) = small.

Marine bird species that are difficult to tell apart:

1. Sooty, Short-tailed and Christmas Shearwaters
2. Laysan and adult Short-tailed Albatrosses
3. Black-footed and young Short-tailed Albatrosses
4. Kermadec, Solander's and Murphy's Petrels
5. White-necked and Dark-rumped Petrels
6. Cook's, Stejneger's and Pycroft's Petrels
7. Bulwer's Petrels, Sooty Storm-Petrels, Swinhoe's Storm-Petrels and Matsudaira's Storm-Petrels
8. Buller's Shearwaters, Dark-rumped Petrels, and White-necked Petrels
9. Audubon's and Newell's Shearwaters
10. Northern Fulmars, Pink-footed Shearwaters and Pale-footed Shearwaters
11. Leach's and Band-rumped Storm-Petrels
12. Long-tailed, Parasitic and Pomarine Jaeger's
13. Red and Red-necked Phalaropes
14. Common and Arctic Terns
15. Immature Tufted and immature Horned Puffins
16. Common and Thick-billed Murres
17. All small auklets

Northern Fulmar (Fulmarus glacialis)

This stocky seabird is commonly entangled in nets set in northern waters, but will only occasionally be entangled in a squid driftnet. It's plumage pattern is extremely variable. Closeup it is not likely to be confused with any other seabird but at a distance dark phase birds could be confused with pale-footed shearwaters (long bill and neck) and light phase birds could be confused with pink-footed shearwaters (long bill and neck).

Medium sized seabird with tube shaped nostrils
Body varies from all dark to all white
**Stocky body with short thick neck
**Bill short, thick and yellowish
Legs and feet bluish to flesh colored
Upperwing usually has a white triangular area in primaries
Bill length = 33-41 mm
Wing length = 280-325 mm
Weight = 580-780 gms

Laysan Albatross (Diomedea immutabilis)

This albatross is frequently entangled in driftnets. It may be confused with adult short-tailed albatross (pink bills, white back) or with vagrant species from the south Pacific (see black-browed albatross).

Large sized marine bird with tube shaped nostrils
Body white below and dark above
**White head, dark back
**Large bill yellow with dark tip in adult,
greyish with dark dip in immature
Underwings white with dark border and central patches
Legs and feet flesh colored
Bill length = 99-114 mm
Wing length = 470-510 mm
Weight = 1,800-3,000 gms.

Black-footed Albatross (Diomedea nigripes)

This albatross is frequently entangled in driftnets. It can be confused with immature short-tailed albatross (tan-pinkish bill).

Large sized marine bird with tube shaped nostrils
**Body solid dark frequently with white around bill and base of tail
**Large dark bill
Underwings dark
Legs and Feet black
Bill length = 94-113 mm
Wing length = 485-533 mm
Weight = 2,100-4,100 gms

Short-tailed Shearwater (Puffinus tenuirostris)

This all dark shearwater will be found most often in the northern parts of the fishing area. It is very difficult to tell apart from the sooty shearwater (long bill). Other species with which it might be confused are pale-footed shearwater (large pale bill, pale legs and feet), Christmas shearwater (smaller, solid dark underwings), dark phase wedge-tailed shearwater (pale or whitish legs and feet, white toe-nails, wedge shaped tail), Bulwer's petrel (much smaller, long wedge shaped tail), Solander's, Murphy's and Kermadec petrels (all have shorter and thicker bills with large nails), dark phase northern fulmar (short and thick yellow bill).

Medium sized seabird with tube shaped nostrils
Small head and large body
Body all dark
Underwings with irregular grey or mottled brown areas
Bill dark and slender
Legs and feet dark
**Bill length 28-36 mm
Wing length = 260-290 mm
Weight = 500-800 gms.

Short-tailed Albatross (Diomedea albatrus)

This albatross is extremely rare (Endangered Species status) and thus will not likely be found in driftnets. Those that are caught will quite likely be banded. Plumage color and pattern varies with age. Immatures will be difficult to distinguish from immature black-footed albatross (black bills).
The only other species with which it might be confused (except for vagrant south Pacific albatross) is the Laysan albatross (black back, yellowish bill).

ADULTS
Large sized marine bird with tube shaped nostrils
Body white below and dark and white above
**White head, white back
**Large pink bill with bluish tip
Underwings white with thin dark border
Legs bluish white
Bill length = 120-145
Wing length = 518-555
Weight = 2,100-4,100 gms.

IMMATURES

Large sized marine bird with tube shaped nostrils
Body solid dark becoming whiter on belly and developing two white patches on upper surface of wing
Dark back becomming whiter with age.
Underwings dark becomming whiter with age
Bill may be tan to pinkish color

Horned Puffin (Fratercula corniculata)

This stocky seabird will occasionally be caught in driftnets in the squid fishing area. Adults are distinctive, but immatures may be confused with immatured tufted puffins (all dark) and rhinoceros auklets (non triangular yellowish bill).

ADULTS
Medium sized seabird without tube shaped nostrils
**Body dark above and white below with white cheeks
**Large triangular bill, yellow with a red tip
Short wings
Legs and feet orange
Bill length = 45-56 mm
Wing length = 182-222 mm

IMMATURES
Medium sized seabird without tube shaped nostrils
**Body dark, lighter (grey or mottled) below with grey cheeks
**Bill smaller and less triangular than adult, blackish with red tip
Short wings
Legs and feet pale

Fork-tailed Storm-Petrel (Oceanodroma furcata)

This dainty grey seabird is infrequently entangled in driftnets. It is fairly distinct but may be confused with the red phalarope (bill thin and nostrils not tube shaped).

Small sized seabird with tube shaped nostrils
**Body gray
Bill small and black
Legs and feet black
Bill length = 14-16 mm
Wing length = 141-169 mm

Leach's Storm-Petrel (*Oceanodroma leucorhoa*)

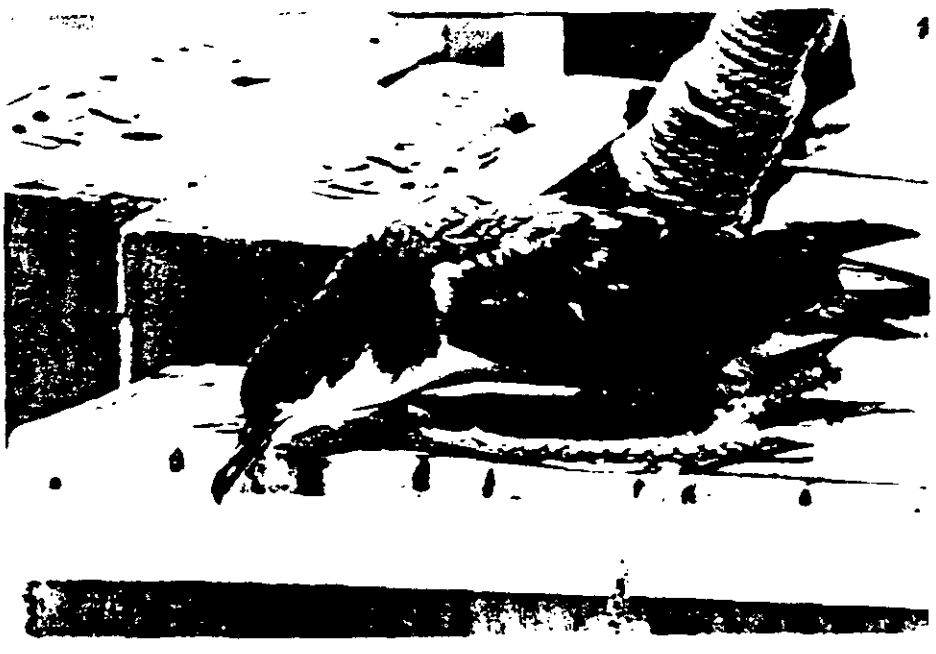
This dainty dark seabird is infrequently entangled in driftnets. It may easily be confused with any other white-rumped storm-petrel. In the driftnet area the most similar species is the band-rumped storm-petrel (rump patch broad and pure).

Small sized seabird with tube shaped nostrils
Body all dark except for a white rump patch
**White rump patch triangular in shape with dark central area
Bill small and black
Legs and feet black
Bill length = 13-17 mm
Wing length = 148-165 mm
Weight = 40-58 gms

Buller's Shearwater (Puffinus bulleri)

This grey and white shearwater will be caught in moderate numbers to low numbers in driftnets. Other species with which it might be confused are gadfly petrels (e.g., Juan Fernandez and Stejneger's petrels) which have short thick bills.

Medium sized seabird with tube shaped nostrils
Small head and large body
Body grey above and white below
**Top of head much darker than back
**Blackish "W" pattern across back of wings and across rump
**Dark slender bill (darkest at tip)
Legs and feet pinkish
Underwing white with thin black border (no black mark at wrist)
Bill length = 38-45 mm
Wing length = 270-300 mm
Weight = ca. 400 gms



Pale-footed Shearwater (Puffinus carneipes)

This all dark shearwater will be caught in moderate to low numbers in driftnets. Other species with which it might be confused are sooty shearwater (dark and thin bill, white patches under wing), short-tailed shearwater (dark and thin bill), Christmas shearwater (smaller, black bill), dark phase wedge-tailed shearwater (pale or whitish legs and feet, white toe-nails, wedge shaped tail, dark bill), Bulwer's petrel (much smaller, dark bill, long wedge shaped tail), Solander's, Murphy's and Kermadec petrels (all have dark bills that are shorter and thicker with large nails), dark phase northern fulmar (short and thick pale bill with yellow tip).

Medium sized seabird with tube shaped nostrils
Small head and large body
Body all dark
Underwings dark with whitish bases to primaries
**Bill large and straw yellow with darker tip
**Legs and feet flesh colored
Bill length = 37-49 mm
Wing Length = 298-337 mm
Weight = 600-1,000 gms.

Tufted Puffin (Fratercula cirrhata)

This stocky seabird will occassionally be caught in driftnets within the squid fishing area. Adults are distinctive, but immatures may be confused with immature horned puffins () and rhinoceros auklets (yellow-orange bill not triangular).

ADULTS
Medium sized seabird without tube shaped nostrils
**Body dark except for white cheek patches
**Bill large, triangular, greenish at base and red-orange at tip
**Yellowish plumes above eyes
**Legs and feet orange
Short wings
Bill length = 53-65 mm
Wing length = 189-236 mm

IMMATURES
Medium sized seabird without tube shaped nostrils
**Body all dark
**Bill small, less triangular than adult, blackish with red tip
Short wings
Legs and feet pale

Adult

Immature

Sooty Shearwater (*Puffinus griseus*)

This all dark shearwater will be the most common marine bird species to become entangled in driftnets in the squid fishing area. It is very difficult to tell apart from the short-tailed shearwater (short bill). Other species with which it might be confused are pale-footed shearwater (large pale bill, pale legs and feet), Christmas shearwater (smaller, solid dark underwings), dark phase wedge-tailed shearwater (pale or whitish legs and feet, white toe-nails, wedge shaped tail), Bulwer's petrel (much smaller, long wedge shaped tail), Solander's, Murphy's and Kermadec petrels (all have shorter and thicker bills with large nails), dark phase northern fulmar (short and thick yellow bill).

Medium sized seabird with tube shaped nostrils
Small head and large body
Body all dark
Underwings with irregular white patches
Bill dark and slender
Legs and feet dark
**Bill length 38-45 mm
Wing Length = 260-290 mm
Weight = 600-1,000 gms.

Short-tailed Shearwater Sooty Shearwater

Field guides

A number of good field guides are available to help on species identification. A few of these guides are listed below.

1. Peter Harrison: A Field Guide to Seabirds of the World. The Stephen Greene Press. (paperback)

2. Peter Harrison: Seabirds - An Identification Guide. Houghton Mifflin Co.

3. David Ainley, Gary Page, Lisa Jones, Lynne Stenzel and Ronald LeValley: Beached Marine Birds and Mammals of the North American West Coast: A Manual for their Census and Identification. U.S. Fish and Wildlife Service.

4. Roger Peterson: A Field Guide to Western Birds. Houghton Mifflin Co.

5. Chandler Robbins, Bertel Bruun, Herbert Zim: A Guide to Field Identification Birds of North America. Golden Press

6. Robert Armstrong: A New and Expanded Guide to the Birds of Alaska. Alaska Northwest Publishing Co.

7. Wildlife Society of Japan: A Field Guide to the Birds of Japan. Kodansha International Ltd.

GUIDE TO THE IDENTIFICATION OF OCEANIC TROUT AND SALMON (FAMILY SALMONIDAE) IN THE NORTHEASTERN PACIFIC OCEAN

Kevin M. Howe
College of Fisheries
University of Washington

The members of the family Salmonidae can be recognized by their fusiform body shape, the possession of an adipose fin and the possession of a pelvic appendage (an elongate, modified scale directly above each pelvic fin). During most of their oceanic life, salmon and trout are silvery on the sides and underside and blueish or greenish on the back (dorsal surface), with various amounts of speckling or spotting on the back and tail.

Although 10-12 species of salmonids may be found in the northeastern Pacific Ocean, only five species of salmon and the rainbow (steelhead) trout are commonly found considerable distances from shore.

A series of characters are listed under each of the species. All of these characters are useful in the definitive identification of each species. Following the salmon section, there is a chart which may be used to distinguish between two particular salmon species. The most useful and easily recognized field characters are denoted by an asterisk *.

Diagnoses

Trout (*Salmo*)

Rainbow (Steelhead) Trout (*Salmo gairdneri*)

- 8 to 12 anal fin rays
- thick caudal peduncle (its least depth less than 9 into standard length)
* - tail usually not deeply forked; tail lobes rounded
* - dense, distinct spotting on back and both tail lobes
- a few silvery streaks may radiate out from base of tail
- weight at maturity: 2.3 - 8.2 kg (5-8 lbs)

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[1] Contribution No. 7 of the Cooperative Systematic Program between the College of Fisheries (UW) and the Northwest and Alaska Fisheries Center (NMFS). Thanks to Colin Harris (UW), Robert French (NMFS) and Janet Wall (NMFS) for information and review.

Oceanic Salmon

Salmon (*Oncorhynchus*)

- 13 to 19 anal fin rays
- thin caudal peduncle (its least depth greater than 10 into standard length)
* - tail usually forked; tail lobes pointed
- spotting and speckling varies with each species (see below)

PINK (Humpy) salmon (*Oncorhynchus gorbuscha*)

* - small scales, 170 or more in row above lateral line
* - large, rather oval and blotchy spots on both lobes of tail and on back (these spots are the largest found on the different species of salmon)
- weight at maturity: 1.4-2.3 kg (3-5 lbs)

CHINOOK (King) Salmon (*Oncorhynchus tshawytscha*)

- large scales, less than 155 in row above lateral line
* - distinct black spots on both lobes of tail and on back
* - black coloration at base of teeth on gums of lower jaw and throughout mouth
- silvery streaks may radiate out from base of tail
- greenish blue to black on dorsum (chinook tend to be the darkest salmon)
- no striations can be felt on ventral caudal fin rays
- weight at maturity: 4.5-13.6 or more kg (10-30 lbs)

COHO (Silver) Salmon (*Oncorhynchus kisutch*)

- large scales, less than 155 in row above lateral line
* - black spots on upper lobe of tail and on back (may be light or faded)
* - white coloration (sometimes blotchy) at base of teeth on gums of lower jaw
- silvery streaks radiating out from base of tail
- greenish blue on dorsum
- striations may be felt on ventral caudal fin rays
- weight at maturity: 2.7-54. kg (6-12 lbs)

Oceanic Salmon

CHUM (Dog) Salmon (Oncorhynchus keta)

- large scales, less than 155 in row above lateral line
* - no spots on tail or back (there may be some speckling on back)
* - silvery streaks radiating out from base of tail
- long, slender caudal peduncle (its least depth about 14 into standard length)
- 18-28 short, stout gill rakers on first gill arch
- large pupil (black portion of eye)
- weight at maturity: 3.6-5.4 kg (8-12 lbs)

SOCKEYE (Red) Salmon (Oncorhynchus nerka)

- large scales, less than 155 in row above lateral line
* - fine black speckling on blueish green back but no spots
* - no spots or silvery streaks on tail
- 28-40 long, slender gill rakers on first gill arch
- weight at maturity: 2.3-3.2 kg (5-7 lbs)

FIELD KEY FOR SALMONIDS

A. Very small scales, Zone A scales average two millimeters across. Large blotchy spots on back and tail.....Pink Salmon, O. gorbu[illegible]ha

or

A. Scales are not small, on adult fish they are generally three millimeters or more across.....B.

B. Slender body shape, not deep bodied. Short head. Square-ended tail. .....Steelhead, S. gairdneri

or

B. Deeper bodied, good sized head, and tail is less square-ended, more forked.....C.

C. Tail is black or dark, no silver streaks or color. No spots on tail and tail is deeply forked. Long gillrakers indicative of a plankton feeder.....Sockeye or Red, O. nerka

or

C. Tail has some silver coloration.....D.

D. Large pupil, pupil is predominately noticable - the iris is less so. Peduncle is slender. No spots on tail or back. Zone A scales are round, not oval, and circuli are only on one-half of scale..... .....Chum or Dog, O. keta

or

D. Pupil is not particularly large, Zone A scales are oval and circuli cover approximately two-thirds of scale. Spots are present on tail and back.....E.

E. Black spots are on the back and usually on both lobes of the tail. In the WOC fishery, some chinook have spots on the upper lobe only. When the peduncle is grasped, the tail fin rays remain spread and do not collapse easily. Gums at the base of the teeth are black. Pyloric caecae count is > 85, range: 87 to 185..... .....Chinook or King, O. tshawytscha

or

E. Tail characters, gum color, pyloric caecae count not as above.....F.

F. Spots are on the back and only the upper lobe of tail fin. The peduncl is very large and when grasped towards the tail, the tail will fold or collapse. There may be some black color in the mouth but the gums at the base of the teeth are white. Pyloric caecae count is < 85, range: 45 to 83.....Coho or Silver, O. kisutch

or

F. Still stuck? We feel these characters are the most universal for differentiation of high seas salmon. Species characteristics vary from region to region and all characters (not just the ones listed here need to be considered for some fish.** Do not rely on any one characte if you have reached this point and are still not sure. Be sure to collect a good scale sample for later verification of your identification.

Note: Historically in the WOC fishery, > 75% of salmon are kings.

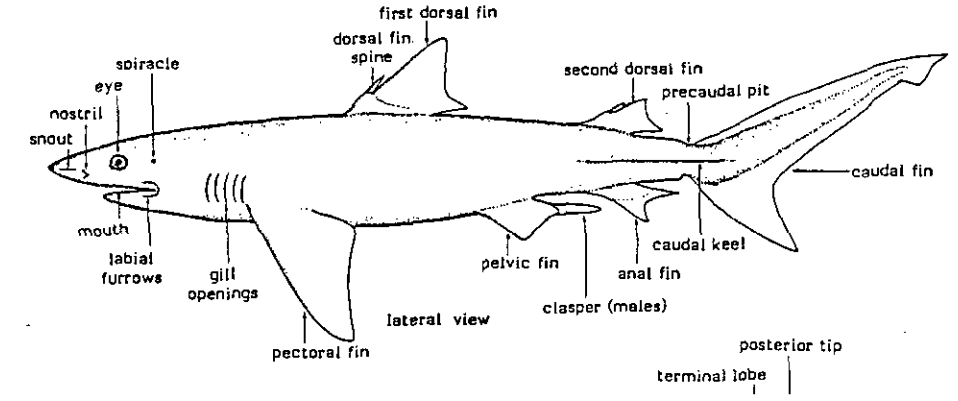
** For further reference see: Pacific Fishes of Canada by Hart, pages 106 - 135, A Field Guide To Pacific Coast Fishes by Eschmeyer, pages 75 - 79, and for WOC observers, Guide to the Coastal Marine Fishe of California, pages 58 - 59.

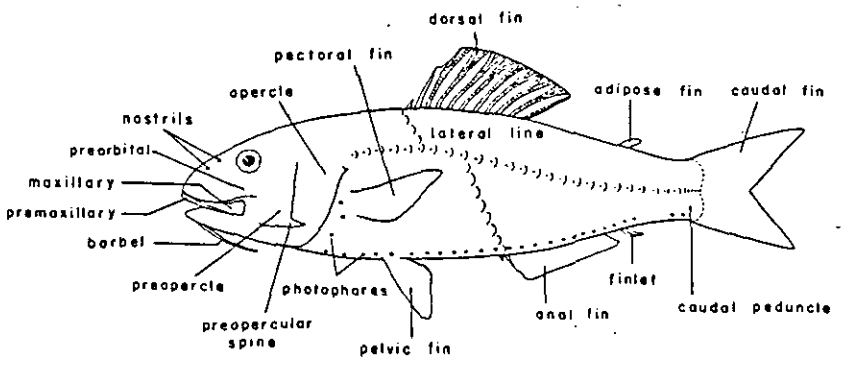
NON-SALMONID FISHES ENCOUNTERED IN NORTH PACIFIC DRIFTNET FISHERIES

This section presents very brief profiles of the most common cartilaginous and non-salmonid bony fishes encountered in the North Pacific high-seas driftnet fisheries. Needless to say, not all of the species that will be caught fishing are presented here, but familiarization with these 24 species will undoubtedly facilitate accurate data collection.

These pages are intended to serve as a quick guide and to supplement other ichthyological reference material. As such, identification keys are not included in this section but rather the distinguishing characteristics that readily identify the species are highlighted in each profile. Attached at the end of the section is a list of some recommended literature that hopefully some if not all will be at your disposal in the field. Most of the illustrations and source material have been extracted in part from these references.

The two diagrams below summarize the terminology used in the profiles to describe the species:



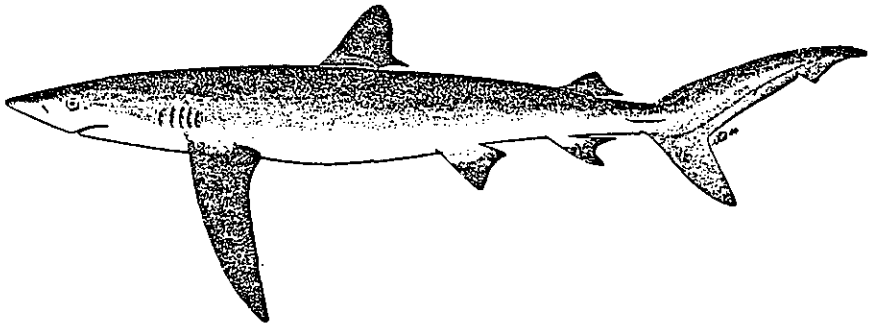


The legend for meristic characters used are as follows:
D=dorsal fin, A=anal fin, P_1=pectoral fin, P_2=pelvic fin, GR=gill rakers,

In addition:
SL=standard length, FL=fork length, TL=total length

BLUE SHARK

SCIENTIFIC NAME: Prionace glauca (Linnaeus, 1758)
JAPANESE NAME: "yoshikirizame"
FAMILY: Carcharhinidae

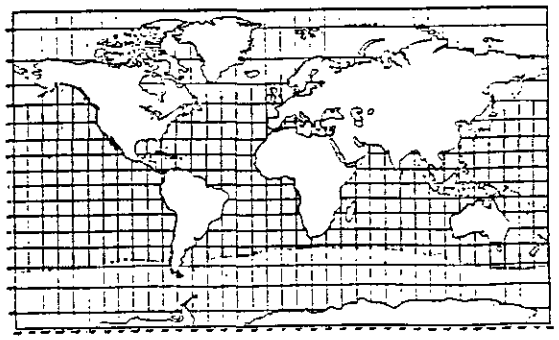


DESCRIPTION: The body of the blue shark is slender and elongate. Distinguishing characteristics of the shark include a long snout that is parabolic in dorsoventral view, large eyes without posterior notches, the absence of spiracles, and the presence of unique papillose gillrakers on the internal gill openings. The sickle-shaped pectoral fins are large and long, especially in relation to the remaining other moderately sized fins. Typical of carcharhinid sharks, the elongated, compressed caudal fin bears a notch just below the end of the upper lobe and there is a nictitating membrane over the eye. The teeth are well differentiated in the upper and lower jaws. The upper teeth are broad, triangular, curved erect to oblique and have serrated edges; the lower teeth are narrower and more erect with slender cusps.

The coloration of this shark is also quite distinctive. Upon capture, the dorsal portions of the body will be a brilliant, dark blue, becoming a lighter but still bright blue on the sides, and becoming abruptly white ventrally.

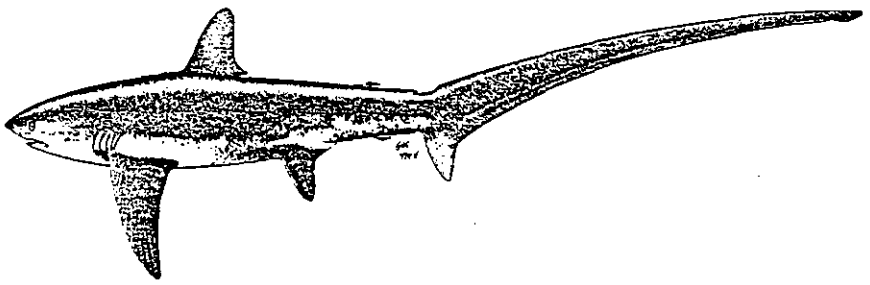
Apparently, the blue shark may attain a maximum size of at least 400 cm with unconfirmed reports in the literature of lengths up to 650 cm.

DISTRIBUTION: This very common and abundant oceanic species is circumglobal in temperate and tropical waters.



COMMON THRESHER SHARK

SCIENTIFIC NAME: Alopias vulpinus (Bonnaterre, 1788)
JAPANESE NAME: "ma-onaga"
FAMILY: Alopiidae

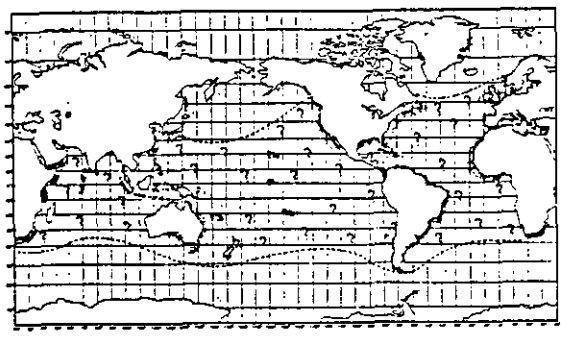


DESCRIPTION: Thresher sharks in general may be immediately recognized by their enormously long, elevated, arched dorsal lobe of the tail which may be equal in length to the rest of the shark. Alopias vulpinis, the most common of these sharks, has a stout body and a head that is convex in dorsal profile. The rear tip of the first dorsal fin is far anterior of the pelvic insertion and the tips of all fins are pointed. The species has moderately large eyes with orbits that do not expand onto the dorsal surface of the head.

Further distinguishing this species from its congeners is the extention of the white color of the abdomen over the pectoral bases. Dorsally, the shark is almost black, gradually shading through various blue, gray and brown tones to white on the belly.

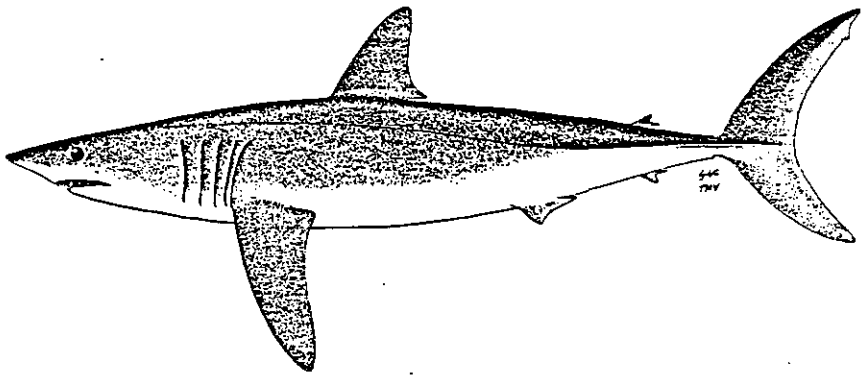
This species reportedly attains a maximum total length of over 550 cm.

DISTRIBUTION: Geographically, the common thresher shark has been described as virtually circumglobal, inhabiting all warm coastal and oceanic waters.



SHORT-FIN MAKO SHARK

SCIENTIFIC NAME: Isurus oxyrinchus Rafinesque, 1809
JAPANESE NAME: "aozame"
FAMILY: Lamnidae

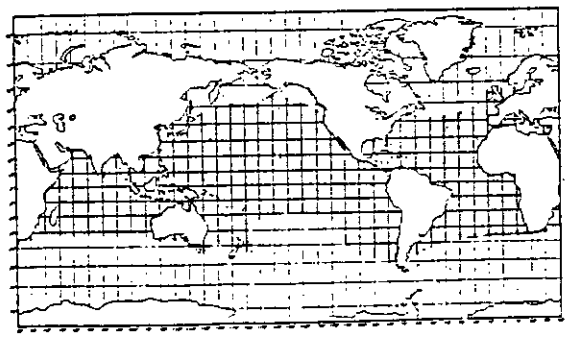


DESCRIPTION: The short-fin mako shark is a fairly large species with a moderately slender spindle-shaped body and a head and snout which are very pointed and conical in shape. A keel is present on a dorso-ventrally flattened caudal peduncle. The caudal fin is lunate with a developed lower caudal lobe. The first dorsal fin origin is above or behind the inner corner of the pectoral fin. The large bladelike teeth without cusplets or serrations are distinctive of mako sharks. This species is readily distinguished from its congener I. paucus (the long-fin mako shark) by the comparably short pectoral fin.

In life, the color of this shark is a deep blue above with white beneath. The underside of the snout and mouth are white as opposed to the long-fin mako shark whose underside of snout and mouth are dusky.

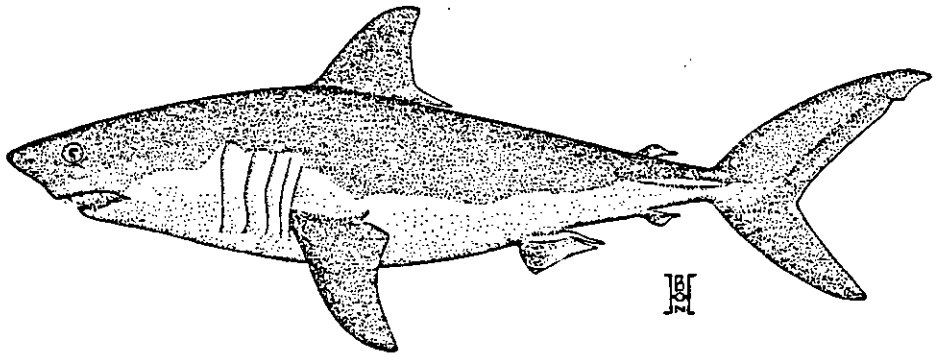
Maximum total length has been estimated to be nearly 400 cm.

DISTRIBUTION: The shortfin mako may be found in all tropical and warm temperate waters world-wide. A common offshore littoral and epipelagic species, they inhabit waters from the surface to a depth of at least 152 m.



SALMON SHARK

SCIENTIFIC NAME: Lamna ditropis Hubbs & Follett, 1947
JAPANESE NAME: "nezumizame"
FAMILY: Lamnidae

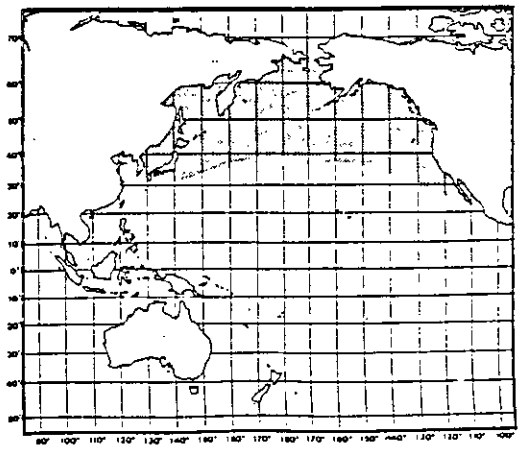


DESCRIPTION: The salmon shark has a heavy, spindle-shaped body with its greatest depth at the origin of the first dorsal fin. The short, conical snout is considered one of the shark's most distinctive features. The species has a large first dorsal fin with a dark free rear tip and minute, pivoting second dorsal and anal fins. The caudal fin is lunate with a developed lower caudal lobe and the caudal peduncle is strongly depressed with 2 lateral keels onto the caudal fin.

The salmon shark is dark bluish gray on the dorsal surface becoming abruptly white on the ventral surface. Dark irregular blotches on the shark's abdomenal surface is another distinctive feature among the adults. The first dorsal fin is uniformly dark (i.e. no abrupt light rear tip as in L. nasus).

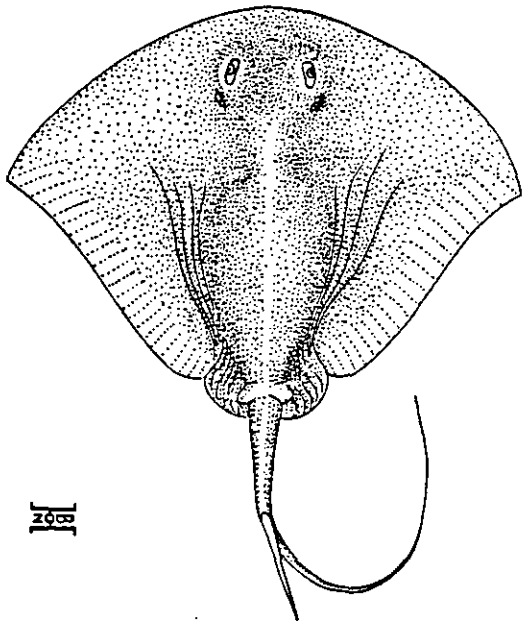
The maximum total length is about 305 cm.

DISTRIBUTION: The species is pelagic and occurs in coastal and oceanic waters of the temperate and subarctic North Pacific Ocean and the Bering Sea.



PELAGIC STINGRAY

SCIENTIFIC NAME: Dasyatis violacea (Bonaparte, 1832)
JAPANESE NAME: "karasu-ei"
FAMILY: Dasyatidae



DESCRIPTION:

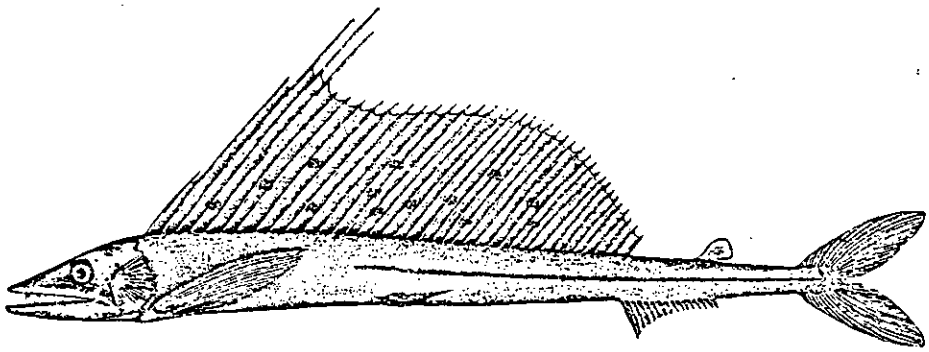
The depressed body of the pelagic stingray is not clearly marked from head or pectoral fins. The rounded rhomboid disc width is 1.3 to 1.4 times the disc length. The snout is blunt such that the whole anterior margin is almost a continuous curve. Five gill slits may be found on the ventral surface. The whiplike tail possesses a ventral fold which falls well short of the tip of the tail. Dorsally, if a fold or ridge is present, it will be very weak.

The disc of the stingray is blackish dorsally, and although a lighter shade ventrally, quite dark ventrally.

DISTRIBUTION: An oceanic species, the species is distributed throughout temperate and tropical seas.

LONGNOSE LANCETFISH

SCIENTIFIC NAME: Alepisaurus ferox Lowe, 1833
JAPANESE NAME: mizu-uo
FAMILY: Alepisauridae



DESCRIPTION: D 32-41; A 13-18; P_1 13-15; P_2 8-10

The longnose lancetfish possesses a very elongate, slender, laterally compressed scaleless body that tapers evenly from the pelvic fins to the caudal peduncle. The head, also laterally compressed, is quite large and angular. Large, daggerlike teeth are present on the palatines and lower jaw. A high dorsal fin originates above or behind posterior margin of the operculum and extends for two-thirds of the length of the body and is in turn followed by a small adipose fin. The pectoral fins are inserted ventrally just behind the head.

The fish upon capture is generally pale and iridescent, with the dorsal surface somewhat darker. All of the fins are dark brown to black.

Adults of this species will easily attain lengths over 1 m, and captures of fish over 2 m are not uncommon. By weight, the heaviest specimen recorded is 4.5 kg.

DISTRIBUTION: Found in pelagic waters from near surface to depths in excess of 300 fathoms of the Atlantic and Pacific Oceans. Although historically thought to occur more commonly in warmer tropical and subtropical waters, increased fishing and monitoring efforts in the pelagic North Pacific have revealed common occurrence of the species in temperate waters as well.

PACIFIC SAURY

SCIENTIFIC NAME: Cololabis saira (Brevoort, 1856)
JAPANESE NAME: "sanma"
FAMILY: Scomberesocidae

DESCRIPTION: D 9-11; A 12-14; P_1 12-14; P_2 6; GR 32-43
5-6 dorsal and 5-7 anal finlets

The body of the Pacific saury is very long, slender, and streamlined. The upper and lower contours are nearly in parallel at mid-body and taper very gently anteriorly and posteriorly. Small pelvic fins are located near the mid-point of the body and the posterior dorsal and anal fins are modified into finlets. Both the upper and lower jaws are pointed, but short and stout.

Color in life can range from a dark green to a greenish-blue on its dorsal surface becoming silvery below. The fins on the lower parts of the body are pale white; the other fin rays are dark.

This small species will attain a length of about 36 cm.

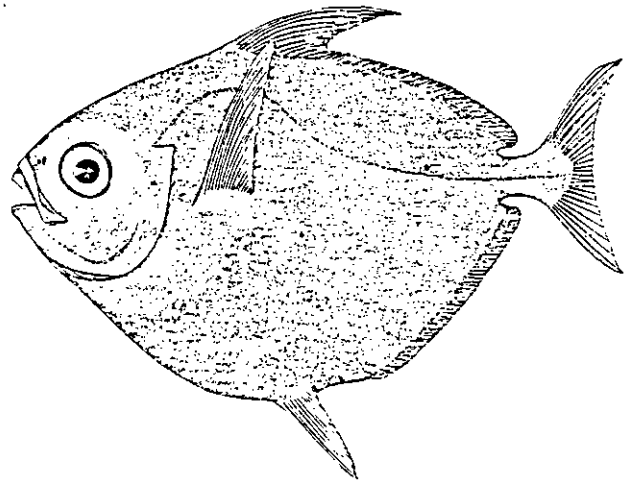
DISTRIBUTION: The sauries are a schooling species that inhabit offshore surface waters of the North Pacific Ocean.

OPAH

SCIENTIFIC NAME: Lampris guttatus (Brünnich, 1788)
JAPANESE NAME: "akamanbô"
FAMILY: Lamprididae

DESCRIPTION: D 50-55; A 34-41; C 17; P_1 25; P_2 14-17

The opah (also known as "moonfish") is a large, easily distinguishable offshore species. A short, deep body is laterally compressed and covered with minute scales. The pectoral fins are long and upright; the base is horizontal. A slender caudal peduncle is laterally compressed with pits above and below the base of a forked caudal fin. The toothless, terminal mouth is moderate in size, directed forward and upward. The eyes are large.



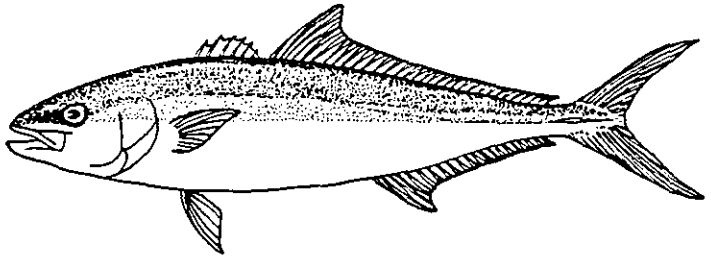
The colorful body of this fish is silvery blue-gray dorsally, rose red below, vermillion on the jaws and fins, and golden around the eyes. The entire body is covered with round, silvery spots in irregular rows.

Sizewise, opah reportedly may reach a length greater than 180 cm FL and may weigh more than 270 kg.

DISTRIBUTION: Opah may be found worldwide at the surface to depths greater than 180 m deep in all tropical and temperate seas.

YELLOWTAIL

SCIENTIFIC NAME: Seriola lalandi Valenciennes,1833
JAPANESE NAME: "hiramasa"
FAMILY: Carangidae



DESCRIPTION: D VII-I, 33-36; A II-I, 20-22; GR 8-9 + 18-21

The yellowtail is an elongate fish, spindle-shaped in outline and laterally compressed but not to the degree of its congener, the amberjack (Seriola dumerili). Lateral profiles are equally convex, the snout is pointed, and jaws about equal. The dorsal and anal fins do not have separate finlets behind them and unlike most of the carangid family members, no bony scutes are present on the lateral line or caudal peduncle.

Fresh specimens will appear metallic blue or blue-green dorsally becoming silvery on the belly. A distinct yellow longitudinal stripe runs from the snout to the caudal peduncle. The pelvic fins are yellow; all of the other fins, including the caudal fin, are olivaceous.

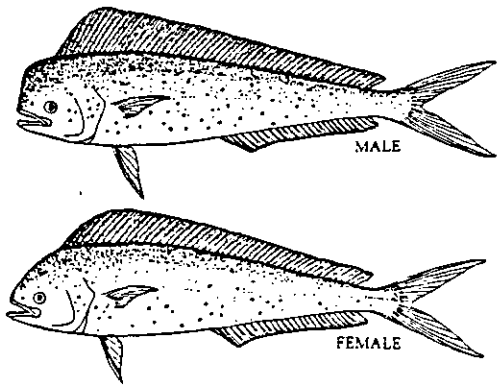
DISTRIBUTION: The taxonomic status of the yellowtail continues to be somewhat confused. Many ichthyologists currently subscribe to the belief that the worldwide yellowtail complex consists of one species, Seriola lalandi and further recognize three subspecies in the Pacific, two north of the equator: S. lalandi aureovittata and S. lalandi dorsalis.
More information is needed to identify the supposed geographic boundaries of these subspecific populations, especially in the central North Pacific.

MAHIMAHI or DOLPHINFISH

SCIENTIFIC NAME: Coryphaena hippurus Linnaeus, 1758
JAPANESE NAME: "shiira"
FAMILY: Coryphaenidae

DESCRIPTION: D 55-65; A 26-29; P_1 18-20; P_2 I, 5; GR 0-1 + 7-9

The body of the mahimahi is elongate and laterally compressed (somewhat of a ribbon-like appearance) with a single dorsal fin originating at the nape and extending to the caudal peduncle. The anal fin, slightly longer than half of the body length, originates just behind the anus and also extends to the caudal peduncle. The pelvic fins fit into a groove in the body and the caudal fin is deeply forked. The species is sexually dimorphic. In males, a pronounced median bony crest on front of the head gives the fish a nearly vertical profile. The forehead on the females is slightly convex. A terminal mouth extends to a vertical axis through the middle of the eye in both sexes.



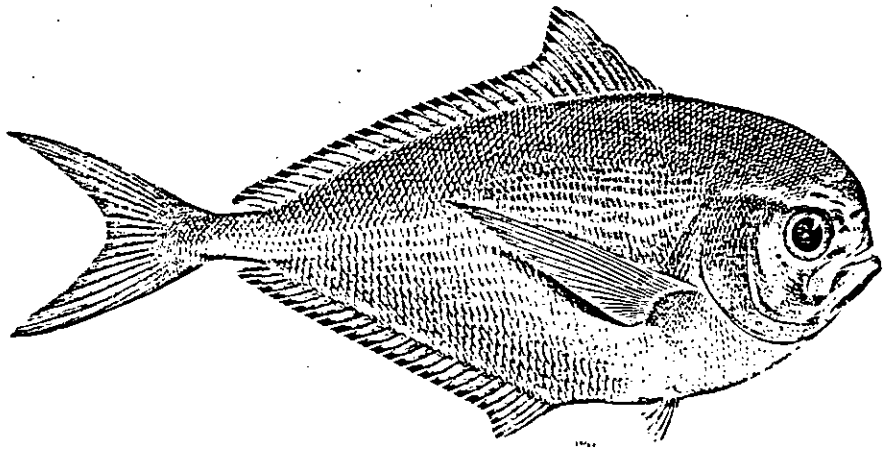
In life, the color of these fishes is variable but usually with brilliant metallic blues and greens on the back, yellow to golden hues on the sides, and yellow to white on the bottom. Numerous small brilliant phosphorescent blue and black spots are also present on the head and body.

Full-grown males of these species are larger than their female counterparts exceeding 180 cm TL.

DISTRIBUTION: The mahimahi are found in surface waters world-wide in all tropical and warm temperate seas. They are renowned for their attraction to floating objects.

PACIFIC POMFRET

SCIENTIFIC NAME: Brama japonica Higendorf, 1878
JAPANESE NAME: "shimagatsuo"
FAMILY: Bramidae



DESCRIPTION: D 33-36; A 27-30; P_1 21-23; P_2 I, 5; GR 17-20

The Pacific pomfret is one of the most abundant fishes caught in the North Pacific driftnet fisheries. The adults of these somewhat disc-shaped, strongly compressed fish have blunt snouts and deep bodies which taper posteriorly to a shallow caudal peduncle. The interorbital space is strongly convex to where the profile is notably arched. Scaled dorsal and anal fins are long at the base and not fully depressible; pectoral fins are long, falcate and pointed; and the caudal fin is lunate.

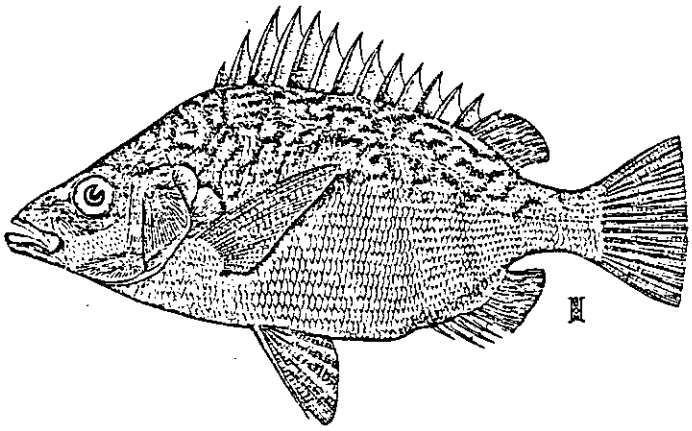
In life and fresh upon capture, the pomfret will be deep purple (nearly black) along its uppermost dorsal areas. Abruptly, the sides become bright silver. All fins with the exception of the anal fin (which is silvery white like the body sides), appear a dusky purple tone. Upon death, the entire animal may become completely black.

Although reported to reach over 90 cm in length, most of the adult fish captured fall in the 30-40 cm FL range.

DISTRIBUTION: Brama japonica are caught throughout the temperate and subarctic North Pacific Ocean. The life history of the species includes seasonal migrations from their "feeding" grounds in the subarctic regions during the summer and fall months to their spawning grounds in the subtropics. A schooling species, the pomfret occur abundantly but also erratically.

PELAGIC ARMORHEAD

SCIENTIFIC NAME: Pseudopentaceros wheeleri Hardy, 1983
JAPANESE NAME: "kusakari tsubodai"
FAMILY: Pentacerotidae



DESCRIPTION: D XIII-XIV, 8-9; A IV, 7-8; P_1 17-18; GR 7-8+16-18

The body of the pelagic armorhead is ovate and compressed. In profile, the dorsal and anal fins are evenly curved. The head is pointed and encased in exposed striated bones, some of which are rugulose or finely wrinkled. The mouth is rather small and terminal with villiform teeth on both jaws and prevomer; the palatines are toothless.

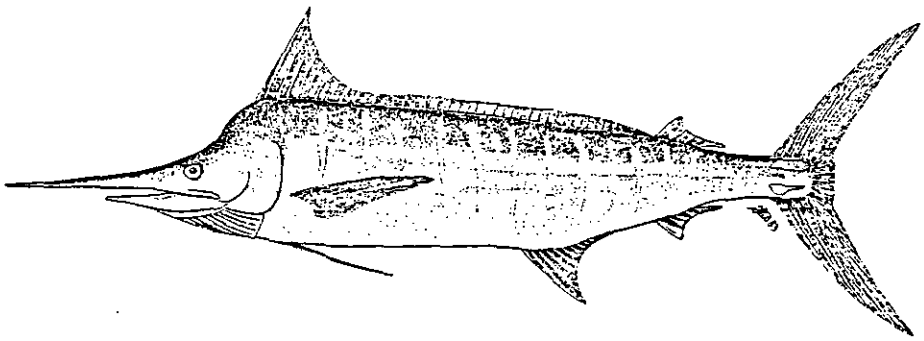
The supposed semelparous armorhead life history includes an epipelagic juvenile/feeding existence in the North Pacific and Gulf of Alaska followed by a return to the Southern Emperor-Northern Hawaiian Ridge (SE-NHR) seamounts where the species assumes a demersal existence to spawn. Although polymorphism is exhibited by the species upon settlement at the seamounts, armorhead appearance when taken on the high seas is consistent. These fish attain 25-30 cm FL prior to their southern migration.

In this pelagic phase, the armorhead is bluish brown with lighter blue vermiculations dorsally becoming nearly white ventrally. The posterior borders of the caudal fin and dorsal rays are translucent.

DISTRIBUTION: The pelagic armorhead occurs widely in the North Pacific Ocean. Benthic specimens have been taken from Japan, the SE-NHR seamounts, and the west coast of North America. The pelagic phase is distributed around the North Pacific subarctic water mass and the Gulf of Alaska. Juvenile specimens have been collected in the transition zones of the central North Pacific.

PACIFIC BLUE MARLIN

SCIENTIFIC NAME: Makaira mazara (Jordan & Snyder, 1901)
JAPANESE NAME: "kurokajiki"
FAMILY: Istiophoridae



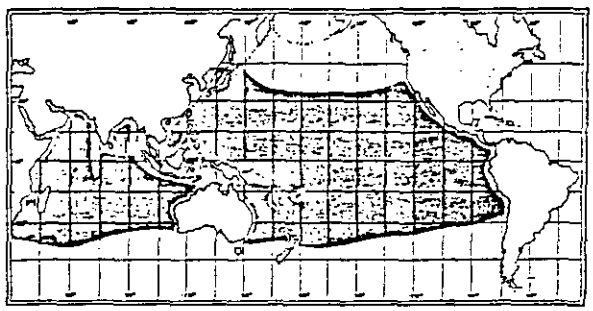
DESCRIPTION: D (38-42)+(6-7); A (13-14)+(6-7); P_1 21-23; P_2 I, 2

The deep, robust body of the Pacific blue marlin is round in cross-section, and not very compressed. The dorsal fin is relatively low, with the anterior lobe shorter than the greatest body depth. The pectoral fins are falcate and can be folded back against the sides of the body (as opposed to its congener M. indica whose stiff, rigid pectoral fin cannot be folded against the body without breaking the joint where it attaches). The nape is extremely elevated and the lateral line system appears in a simple loop pattern. The bill is long and extremely stout.

In a freshly caught specimen, the fish is a brilliant, deep, metallic blue color dorsally and silvery white ventrally. Upon death, the blue tones will change to a leaden gray color with brownish hues. About 15 rows of pale vertical stripes may also be visible, which may lead to confusion with striped marlin (Tetrapturus audax). The blue marlin, however, has a lower dorsal fin, a more robust body, and the looping lateral line system. The simpler lateral line system in the striped marlin is often even difficult to see.

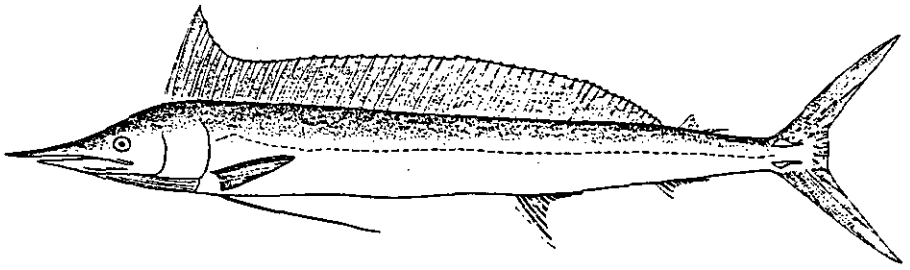
The largest blue marlins have been reported to be greater than 440 cm TL and over 900 kg. Commonly, average marlins caught by commercial longline fishing vessels fall within the 200 to 300 cm TL range.

DISTRIBUTION: The Pacific blue marlin are found primarily in the tropical and subtropical waters of the Pacific and Indian Oceans. Their distribution and migration patterns appear confined to the waters warmer than the 24°C surface isotherm.



SHORTNOSE SPEARFISH

SCIENTIFIC NAME: Tetrapturus angustirostris Tanaka, 1915
JAPANESE NAME: "fûraikajiki"
FAMILY: Istiophoridae



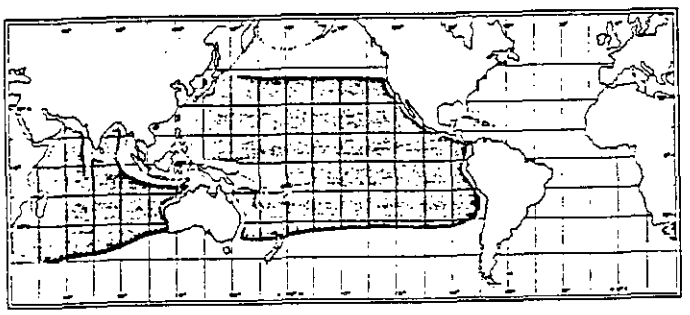
DESCRIPTION: D (47-50)+(6-7); A (12-15)+(6-7); P_1 18-19; P_2 I, 2

The shortnose spearfish is easily distinguished from the other billfishes by the shortness of its bill which extends only a comparatively short distance beyond the lower jaw. This smallish billfish has an elongate, fairly compressed body which is round in cross-section. The anterior rays of the low, long first dorsal fin is higher than the greatest body depth; the height of the remainder of the fin is somewhat uniform throughout.

In life, the body of this species will be a deep, metallic blue dorsally, bluish splattered with brown laterally, and silvery white ventrally without spots, stripes, or any other significant markings. Upon death, colors will fade to a dark, slaty gray.

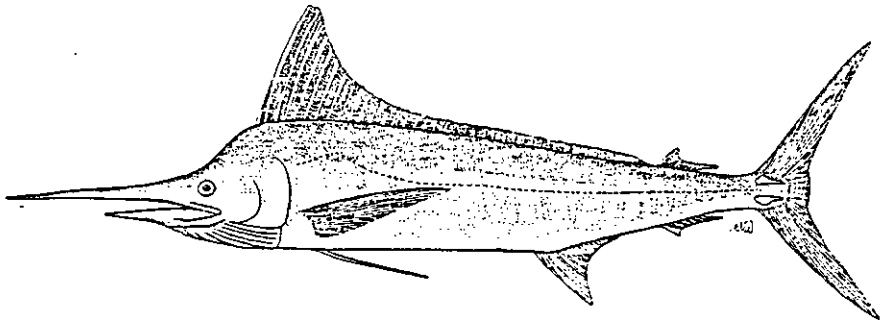
The maximum known size for the species is about 200 cm TL and 52 kg in weight. Commercially, average sizes are reported to be 135-150 cm FL and about 18 kg.

DISTRIBUTION: The spearfish is an oceanic, pelagic fish that is distributed throughout the tropical and temperate Pacific and Indian Oceans. They normally are not found in coastal or enclosed waters.



STRIPED MARLIN

SCIENTIFIC NAME: Tetrapturus audax (Philippi, 1887)
JAPANESE NAME: "makajiki"
FAMILY: Istiophoridae



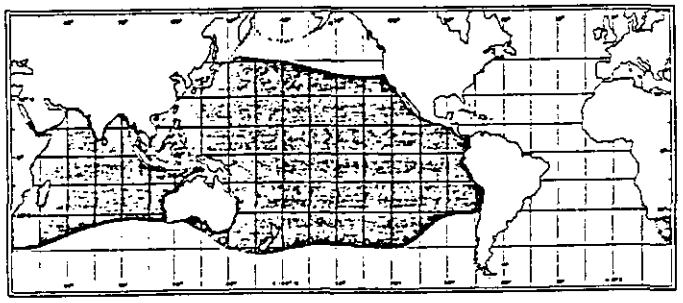
DESCRIPTION: D (37-42)+(5-6); A (13-18)+(5-6); P_1 18-22; P_2 I, 2

The striped marlin is smaller than the Pacific blue marlin and will have a less robust, more laterally compressed body (especially in the anal fin area). The anterior lobe of the first dorsal fin is pointed and high; the first ray at least as long as the greatest body depth. The height of the remainder of the fin decreases gradually posteriorly. The long and narrow pectoral fins have pointed tips and may be depressed against the body. The nape is fairly elevated and the lateral line is single, curving above the base of the pectoral fin and then continuing in a straight line to the caudal peduncle.

The color of the body upon capture is a deep, metallic cobalt blue dorsally becoming silvery white towards the belly. The sides are marked by a series of 15 rows of vertical stripes. Following death the bright blue color will fade to a darkish gray and the stripes will persist in a faded condition.

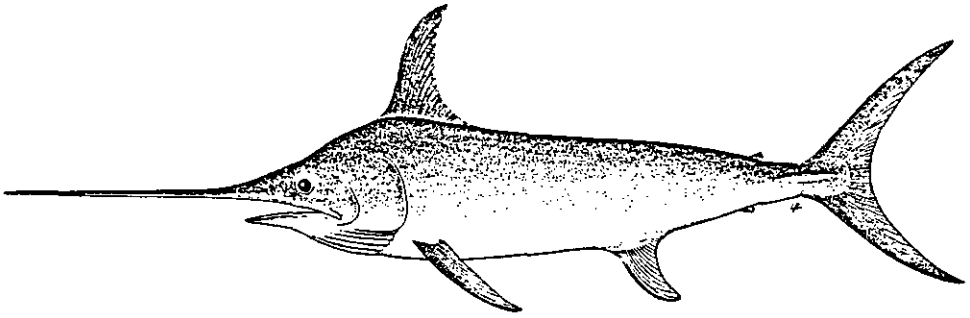
The maximum size attained by this species exceeds 350 cm TL and 200 kg in weight. Commercially, most of the fish captured will be <300 cm TL.

DISTRIBUTION: The striped marlin is an epipelagic, oceanic species found in the tropical, subtropical, and temperate waters of the Pacific and Indian Oceans.



SWORDFISH

SCIENTIFIC NAME: Xiphias gladius Linnaeus, 1758
JAPANESE NAME: "mekajiki"
FAMILY: Xiphiidae



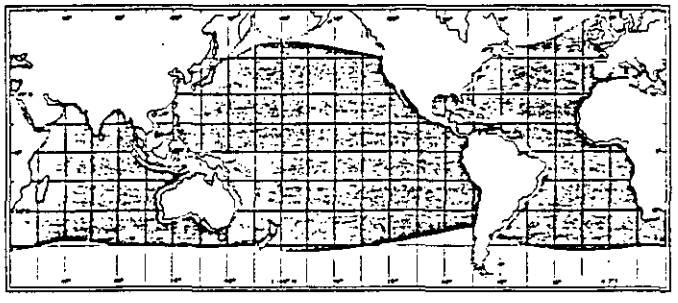
DESCRIPTION: D (34-49)+(4-6); A (13-17)+(3-4); P_1 16-19

The swordfish or broadbill differs from the marlins in the absence of scales, teeth, and pelvic fins. In addition, these fish only have a single keel on the caudal peduncle as opposed to the two of other billfishes. The spear is extremely long and flat; the dorsal fin is high and short. Swordfish have an elongate, cylindrical body which tapers rather uniformly anteriorly to posteriorly; the lateral line is absent. Long, falcate pectoral fins are situated low on the body. Young, preadults of this species undergo drastic morphological changes and appear quite different from the adults. These transformations will not be described here.

Coloration of the swordfish can vary greatly. The fish may appear blackish brown, dark gray, or leaden blue dorsally, gradually becoming lighter on the ventral side. All fins are brown.

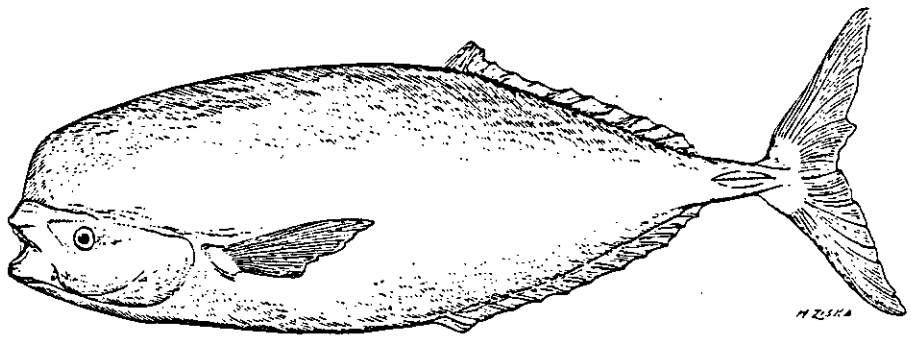
Largest specimens reportedly have exceeded 500 cm in length and 500 kg, however, most commercially caught swordfish are less than 200 cm. Females of the species tend be larger than the males.

DISTRIBUTION: Xiphias gladius is an epi- and mesopelagic species occurring throughout the world's oceans and seas. Vertical and horizontal distributions are temperature dependent.



LOUVAR

SCIENTIFIC NAME: Luvarus imperialis Rafinesque, 1810
JAPANESE NAME: "amashiira"
FAMILY: Luvaridae



DESCRIPTION: D I, 11-13; A I, 12-14; P_1 14-18; P_2 I

The louvar undergoes a drastic metamorphosis from larva to adult. At about 100 to 200 mm SL, the juvenile forms of this species begin to resemble an adult as described in this account.

The body of this monotypic species is fusiform and slightly compressed. The blunt head has a projecting forehead, a transverse groove running just above the eyes, and a small, protrusible mouth. The right and left pelvic fins unite to form a single spine depressible into a groove. A large median caudal keel is flanked by small accessory keels on the caudal peduncle region.

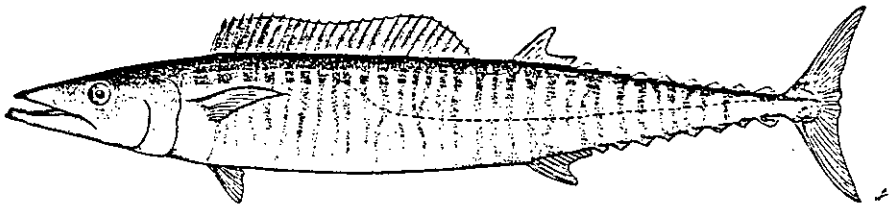
The body and head are bluish dorsally, silvery pink below. The caudal fin is pink, with a round blackish spot at its base. The dorsal and anal fins are black; the pectorals yellow or pink.

This fish reportedly will attain sizes greater than 2 m SL and 140 kg.

DISTRIBUTION: Louvars are epipelagic fishes that have been reported from all tropical and temperate oceans of the world and the Mediterranean Sea but is nowhere abundant.

WAHOO

SCIENTIFIC NAME: Acanthocybium solandri (Cuvier, 1831)
JAPANESE NAME: "kamasu-sawara"
FAMILY: Scombridae



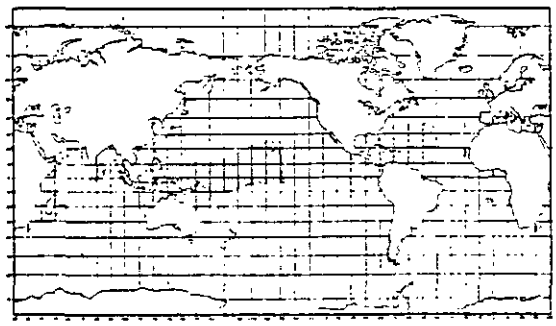
DESCRIPTION: XXIII-XXVII, 12-16; A 12-14; P_1 23-24; P_2 I, 5

Of all the tuna related species, the wahoo is the most easily distinguished. Their body is very elongated and semifusiform and covered with small scales. On a long, slender, sharp-pointed head is a large mouth filled with about 50 triangular, laterally compressed finely serrated teeth closely set in a single series on both jaws. A single lateral line abruptly curves downward under the first dorsal fin.

Typical of pelagic species, the wahoo is a dark blue dorsally becoming silvery below. Bluish irregular vertical bars (some doubled or y-shaped) appear laterally on the body.

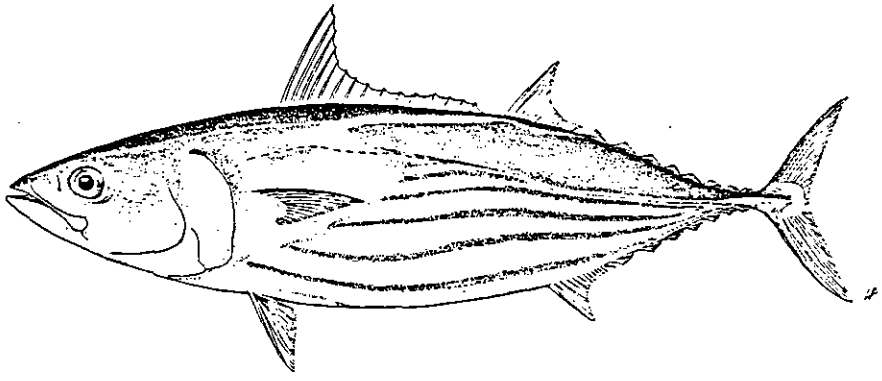
The maximum size of the species is reported to be 210 cm FL and 83+ kg.

DISTRIBUTION: Considered primarily an epipelagic gamefish, the wahoo are found worldwide in tropical and subtropical waters.



SKIPJACK TUNA

SCIENTIFIC NAME: Katsuwonus pelamis (Linnaeus, 1758)
JAPANESE NAME: "katsuo"
FAMILY: Scombridae



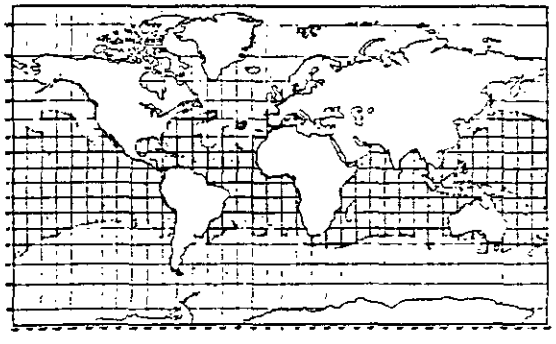
DESCRIPTION: D XV-XVI, 14-15; A 14-15; P_1 26-28; P_2 I, 5;
GR 16-21 + 34-41; 8 dorsal and 6-7 anal finlets

The skipjack tuna has an oblong, robust, fusiform body (nearly round in cross-section) with smooth skin that lacks scales except for the corselet and lateral line regions. The species bears a large, long conical head, and a terminal mouth with small, conical teeth in a single series.

The coloration of the skipjack tuna is its most distinguishing characteristic. In life, the fish will appear a deep, dark purplish blue dorsally, becoming silvery with four to six very conspicuous black longitudinal bands on the lower sides and belly.

These tuna can reportedly attain fork lengths greater than 100 cm, weighing nearly 35 kg. They are more commonly captured up to 80 cm FL and weigh 8 to 10 kg.

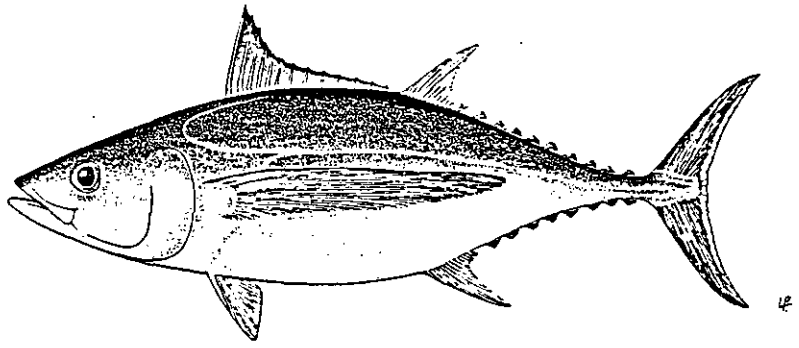
DISTRIBUTION: A known epipelagic, schooling species, skipjack are cosmopolitan in tropical and warm-temperate waters. In general, their distribution is concentrated within the 15°C isotherm. During the day, they can range from the surface to about 260 m deep but apparently confine themselves to the surface at night.



ALBACORE

SCIENTIFIC NAME: Thunnus alalunga (Bonnaterre, 1788)
JAPANESE NAME: "binnaga" (also "tonbo" and "bincho")
FAMILY: Scombridae

DESCRIPTION: D XIII-XIV, 14-16; A 14-15; P_1 32-35; P_2 I, 5;
GR 7-10 + 18-22; 7-8 dorsal and 7-8 anal finlets

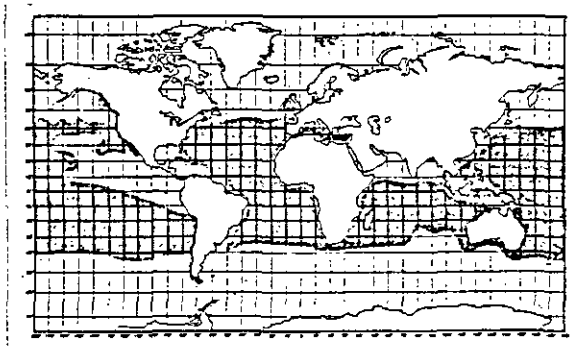


The albacore has the fusiform, elongate body shape typical of the tunas. The greatest body depth however, occurs at or only slightly anterior to the second dorsal fin; which is at a more posterior point than in other tunas. It is readily recognized and distinguished from other tunas by its large eyes and by the very long pectoral fins, which will reach well beyond the end of the second dorsal fin base.

The color of the body is a blackish blue dorsally and silvery on the sides and belly. A faint lateral iridescent blue band may run along side a live fish. The anal finlets have no yellow color and the caudal fin has a narrow white posterior margin.

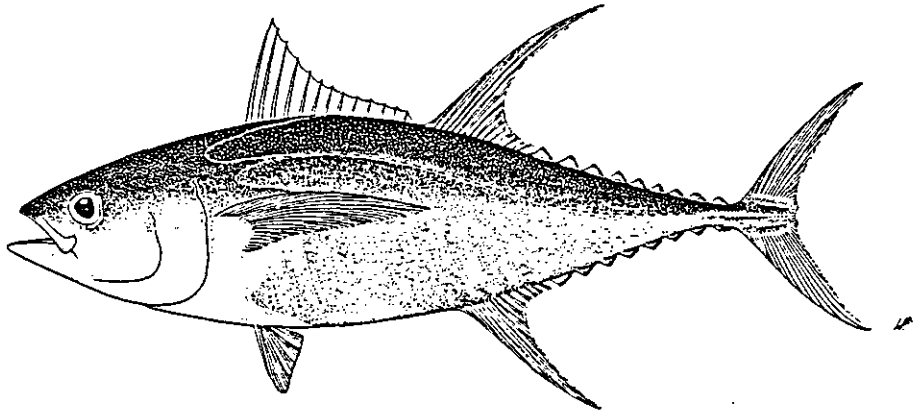
The albacore is the target species for several types of commercial fisheries including longlining, live-bait fishing, trolling, purse seining, and surface large-mesh driftnets. The size of albacore tends to be on the smaller side when taken with gear fished at the surface as opposed to longline caught fish. The maximum size attained by the species is reported to be 127 cm FL.

DISTRIBUTION: Albacore are cosmopolitan in tropical and temperate waters of all oceans, extending north to 45° to 50°N lat. and south to 30° to 40°S (but not at the surface between 10°N and 10°S. They tend to concentrate along thermal discontinuities (oceanic fronts of the North Pacific Transition Zone). The depth distribution in the Pacific ranges from the surface down to at least 380 m and is governed by the vertical thermal structures and oxygen contents of the water masses.



YELLOWFIN TUNA

SCIENTIFIC NAME: Thunnus albacares (Bonnaterre, 1788)
JAPANESE NAME: "kihada" (or "kihada maguro")
FAMILY: Scombridae



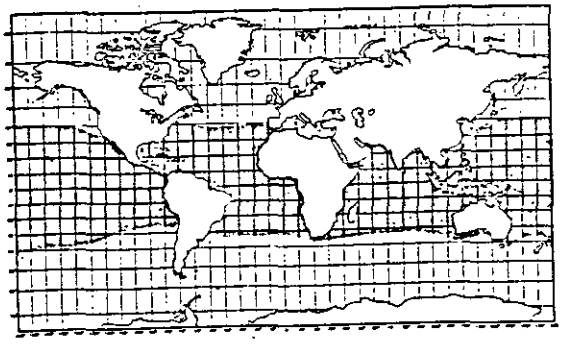
DESCRIPTION: D XII-XIV, 13-16; A 12-15; P_1 33-36; P_2 I, 5;
GR (7-9) + (20-23); 8-10 dorsal and 7-10 anal finlets

Yellowfin tuna, although typically fusiform like other tunas, has somewhat of a more elongated body and smaller head. The body is deepest near the middle of the first dorsal fin base. Large specimens distinctively have remarkably long second dorsal and anal fins, some exceeding 20% of the fish's fork length. Younger, smaller yellowfin may be distinguished from their bigeye tuna counterparts by the lack of striations on the ventral side of the liver.

Upon capture, yellowfin will appear a dark metallic blackish blue dorsally, changing through a band of yellow on the sides to silver ventrally. The dorsal and anal fins and finlets are bright yellow with black borders on the finlets. The belly region is frequently crossed by about 20 slightly oblique broken lines of light, pale spots.

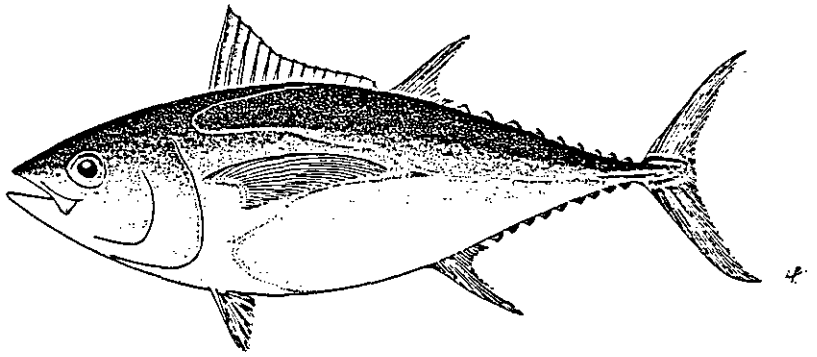
Commonly captured up to 150 cm FL, the largest specimens exceed 200 cm FL, weighing more than 175 kg.

DISTRIBUTION: Yellowfin tuna may be found worldwide in all tropical and subtropical oceans. Their vertical distribution, bounded by 18° and 31°C, is influenced by the thermal structure of the water column. In areas with marked oxyclines, yellowfin are essentially confined to the upper 100 m.



BIGEYE TUNA

SCIENTIFIC NAME: Thunnus obesus (Lowe, 1839)
JAPANESE NAME: "mebachi" or "mebachi maguro"
(a small bigeye tuna may also be called "daruma"
FAMILY: Scombridae



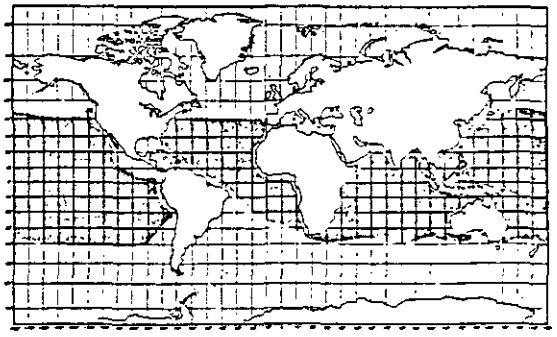
DESCRIPTION: D XII-XIV, 13-15; A 13-14; P_1 32-35; P_2 I,5;
GR 7-10 + 18-19; 8-9 dorsal and 8-9 anal finlets

Bigeye tuna has a fusiform body, slightly compressed laterally, and elongated towards the tail base. A large species, the body is deepest near the middle of the first dorsal fin base. Larger specimens may be recognized by its extremely plump, robust body and unusually large eyes (hence, the vernacular name). Smaller, young fish may be difficult to distinguish from yellowfin tuna. In fish > 30 cm, the ventral surface of the liver will be striated in bigeye tuna (lacking in yellowfin).

In life, the bigeye tuna is dark blue to black dorsally, and silvery white ventrally. An iridescent greenish-yellow patch is present from the eye to above the base of the pectoral fin. The second dorsal and anal fins are light yellow and the finlets are bright yellow with black edges.

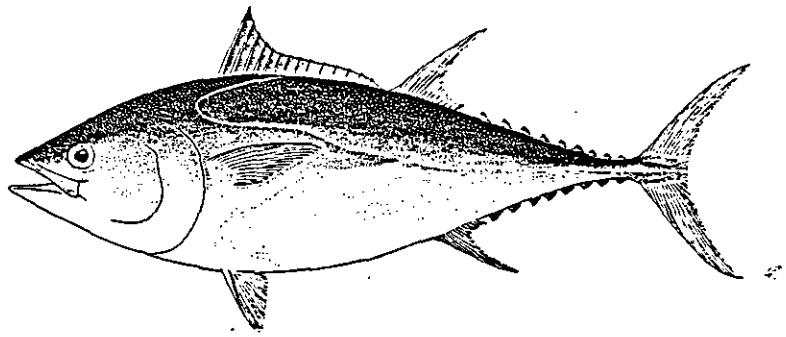
The largest reported bigeye exceed 200 cm FL and are common to 180 cm. The all-tackle angling record for the Pacific Ocean is 197.3 kg.

DISTRIBUTION: Bigeye tuna are found worldwide in tropical and subtropical waters of the Atlantic, Indian, and Pacific Oceans. These fish occupy epipelagic and mesopelagic oceanic regions from the surface to about 250 m depth. Temperature and thermocline depth seem to the primary environmental factors influencing the vertical and horizontal distribution of the species.



NORTHERN BLUEFIN TUNA

SCIENTIFIC NAME: Thunnus thynnus (Linnaeus, 1758)
JAPANESE NAME: "kuromaguro"
FAMILY: Scombridae



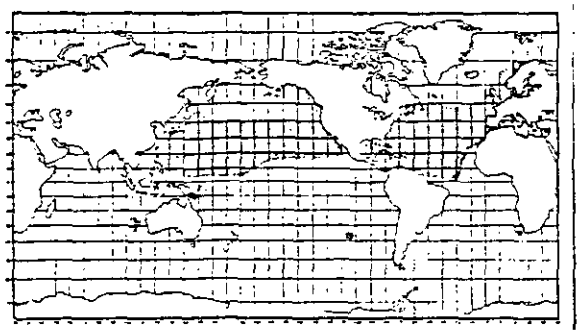
DESCRIPTION D XIII-XV, 13-15; A 3-15; P_1 31-38; $_2$ I, 5;
GR 9-16 + 21-28; 8-9 dorsal and 7-8 anal finlets

Northern bluefin tuna has a robust, typically fusiform body (deepest near the middle of the first dorsal fin base) tapering rapidly to the tail. A relatively small eye and short pectoral fins (<80% of head length) distinguish this species from related species.

The color of the bluefin tuna is a dark, steely blue dorsally becoming progressively lighter to a silvery grey ventrally. In freshly captured specimens, colorless transverse lines alternated with rows of colorless dots will be visible. Dorsal and anal finlets are dusky yellow with black edges.

The largest of the tunas, northern bluefin tuna reach a maximum of 300 cm FL, and are commonly captured up to 200 cm FL. By weight, large fish have been reported over 500 kg, with the all-tackle angling record for the species to be 679 kg.

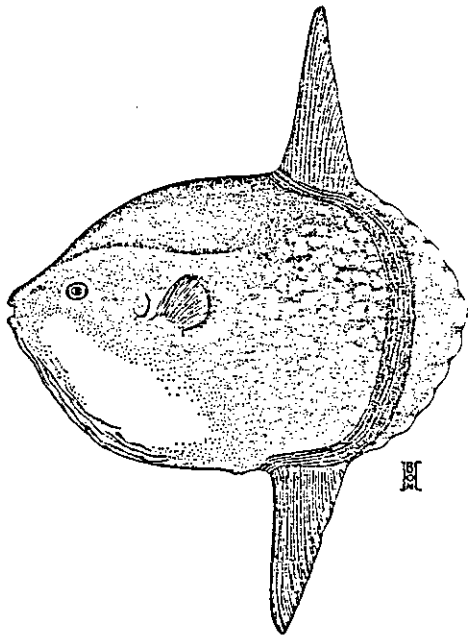
DISTRIBUTION: There are at least two subspecies of these epipelagic fishes, one in the Atlantic and one in the Pacific. Within these regions, the species may be found in all tropical and temperate waters. Although primarily oceanic, bluefin tuna seasonally will come close to shore.



OCEAN SUNFISH

SCIENTIFIC NAME: Mola mola (Linnaeus, 1758)
JAPANESE NAME: "manbô"
FAMILY: Molidae

DESCRIPTION: D 16-18; A 14-17; P_1 12-13



The ocean sunfish is one of the most recognizable species in the ocean. The compressed body is oval in outline; truncated at the posterior end. A "pseudo-caudal fin" or "calvus" is short with a wavy or scalloped margin and has rays that blend into, and are difficult to distinguish from, the posterior parts of the high, matching dorsal and anal fins. The head has a prominent ridge above the eye in large specimens; the eyes and the mouth are both small. The species lacks scales or a lateral line and instead is covered by a thick skin which is leathery in texture and contains numerous patches of rough, bony tubercles.

The color of the Mola mola in general exhibits a grayish to brownish hue with silver reflections. The tones are darker dorsally and nearly a dirty white on the belly. Light spots may be present on the sides of the body.

A giant species, the ocean sunfish are known to attain sizes larger than 300 cm TL and may weigh as much as 1,500 kg. Normally, most specimens will weigh less than 500 kg.

DISTRIBUTION

The sunfish may be found in the surface waters of all warm and temperate oceans and seas.

IV. Species identification

With a little experience, sea turtles in the hand are easy to identify. All identified turtles must, however, have supplemental information to allow for independent confirmation of identifications. Key characters for separating species are provided in this packet in the form of a Dichotomous Key, a Summary Identification Guide and several illustrations of diagnostic features. On the "Sea Turtle Biological Sampling Form", list as many features as possible under "comments" to support your identifications. Do this even for turtles seen only at a distance and not brought onboard.

The sea turtles which may be encountered in the North Pacific Transition Zone where the high-seas driftnet vessels operate are:

Olive Ridley (Lepidochelys olivacea)
Loggerhead (Caretta caretta)
Green (Chelonia mydas)
Leatherback (Dermochelys coriacea)
Hawksbill (Eretmochelys imbricata)

These five species may be identified by using the following key with accompanying illustrations modified from Brongersma's European Atlantic Turtles. Color notes are not accurate for recently hatched animals.

1a. Carapace covered with a thick, leathery skin, without horny scutes; carapace strongly tapering behind (Fig. 1c), with seven longitudinal keels (ridges) which may be smooth to distinctly notched. Upper jaw with three deep notches, one median and one on either side; the notches are separated from one another by tooth-like cusps (Fig. 2c). Blackish or brownish above (sometimes described as having a greenish tinge), often with scattered, small whitish or pinkish irregular spots; lower surface whitish, with black markings. Very large turtles, adult specimens reaching a total length of 275 cm (9ft.).....Leatherback

1b. Shell covered with horny scutes (i.e., hardshell turtles) 2

2a. Five or more costal scutes (C1-C5) on either side, anteriormost very small; nuchal (N) in contact with first costal (C1) (Figs. 1a, 1b); two pairs of prefrontal scales, which may have one or more additional scales wedged in between them (Fig. 2a,b); in the young and halfgrown each vertebral (V1-V5) shows a strong keel, knoblike or spinelike posteriorly which disappears when the specimen grows older.....3

2b. Four costal scutes (C1-C4) on either side; nuchal (N) separated from the first costal (C1) by the first vertebral (V1) (Figs. 1d, 1e); one pair (Fig. 2d) or two pairs (Fig. 2e) of prefrontal scales.....4

3a. Five or more costal scutes, boundaries indistinct. Four (rarely three) inframarginal scutes on either side of the plastron (Fig. 5b); each inframarginal with a pore at its hind border (Fig. 5b); carapace more or less roundish in outline, sometimes even slightly broader than long (measured in straight line); color gray green or olive green. Length of shell up to 70 cm (27.5in.).....Olive Ridley

3b. Five costal scutes (rarely four on one or both sides) (Fig. 1a); three inframarginal scutes (Fig. 5a) on either side, without pores (sometimes four or five inframarginals are present, but then the numbers are usually different on the right and left sides); carapace distinctly longer than broad; color reddish brown or orange. Length of shell up to 100 cm (40 in.)..... .....Loggerhead

4a. Two pairs of prefrontals (Fig. 2e); the scutes of the carapace are overlapping (i.e., shingled or imbricate) except in very young or very old specimens; the vertebrals (V1- V5) are more or less pointed behind (Fig. 1e); in young and halfgrown specimens three low and narrow, more or less continuous keels are present on the carapace (one on the vertebral and one on either side on the costals, converging posteriorly); cutting edge of lower jaw not markedly serrated (Fig. 3d). Length of shell up to 92 cm (36in.) ..... Hawksbill

4b. A single pair of prefrontals (Fig. 2d); the scutes of the carapace do not overlap and they are not pointed posteriorly. In the very young a trace of keels may be found, but already in the halfgrown these have disappeared; cutting edge of lower jaw with a stongly serrated margin (Fig. 3c). Length of shell up to 140 cm (55 in.)..... Green

A small proportion of all sea turtle populations and individuals vary from the normal scute counts used in this key. However, the key and the following Summary Identification Guide include a number of more or less independent criteria for species identification so if, for instance, the dorsal scute count is obviously irregular, try other characters in combination. Generally, a clue to the presence of an abnormal count are scutes that are irregular in shape and lack of bilateral symmetry. (Most animals, for example, generally have equal numbers of costal scutes on each side of the carapace.)

The olive ridley often shows irregular costal scute counts which are usually higher than the minimum count of 5 on each side listed in the key. This is by far the most variable species with respect to costal scute counts and prefrontal scale configuration.

Recently hatched animals (those with a carapace length of less than three inches) will have somewhat different color patterns, but all the scute and scale counts are the same. Hatchling green turtles and leatherbacks will be black to dark gray above and on the under side of the limbs and generally white on the plastron. Leatherback

hatchlings also have 5 distinct white stripes (head to tail) on the carapace. Hatchling hawksbills, olive ridleys, and loggerheads will be gray, black or reddish above and below. Later they develop a lighter ventral coloration.

Table 1. **SUMMARY IDENTIFICATION GUIDE FOR SEA TURTLES**

Species Character	Leatherback	Hawksbill	Green	Olive Ridley	Loggerhead
Dorsal Color	Black with white spots	Mottled brown yellow & black; "tortoise shell" pattern	Splotching or radial patterns of brown, green, & black	Uniform gray/ green or olive; often with red algae on back of carapace	Reddish brown or orange
Maximum Total Length	Greater than 7 ft.	Less than 3 ft.	Less than 4 ft.	Less than 3 ft.	Less than 4 ft.
Shell shape	Strongly tapered to a posterior point	Tapered shell longer than broad	Longer than broad; somewhat tapered	Nearly round somewhat tapered	Longer than broad; somewhat tapered
Carapace Features	Prominent longitudinal ridges, often knobby or notched; lacks horny scutes	Overlapping scutes; vertebral knobs on juveniles	Smooth; little fouling	Indistinct scute boundaries; costal scutes often very narrow; vertebral knobs on juveniles	Often heavily fouled; vertebral knobs on juveniles
Head Shape & Size	Large & notches in upper jaws; width equal to depth	Small; narrow head & beak with pronounced overbite; depth greater than width	Small; rounded face; serrate jaw margin; depth equal to width	Medium; width greater than depth	Very large - wider than deep
Prefrontal Scales	None	2 pair	1 pair	2 pair; often irregularly divided	2 pair; often irregularly divided
Costal (each side carapace)	None	4	4	5 or more	5
Inframarginal (each side plastron)	None	4	4	4, with inframarginal pores	3

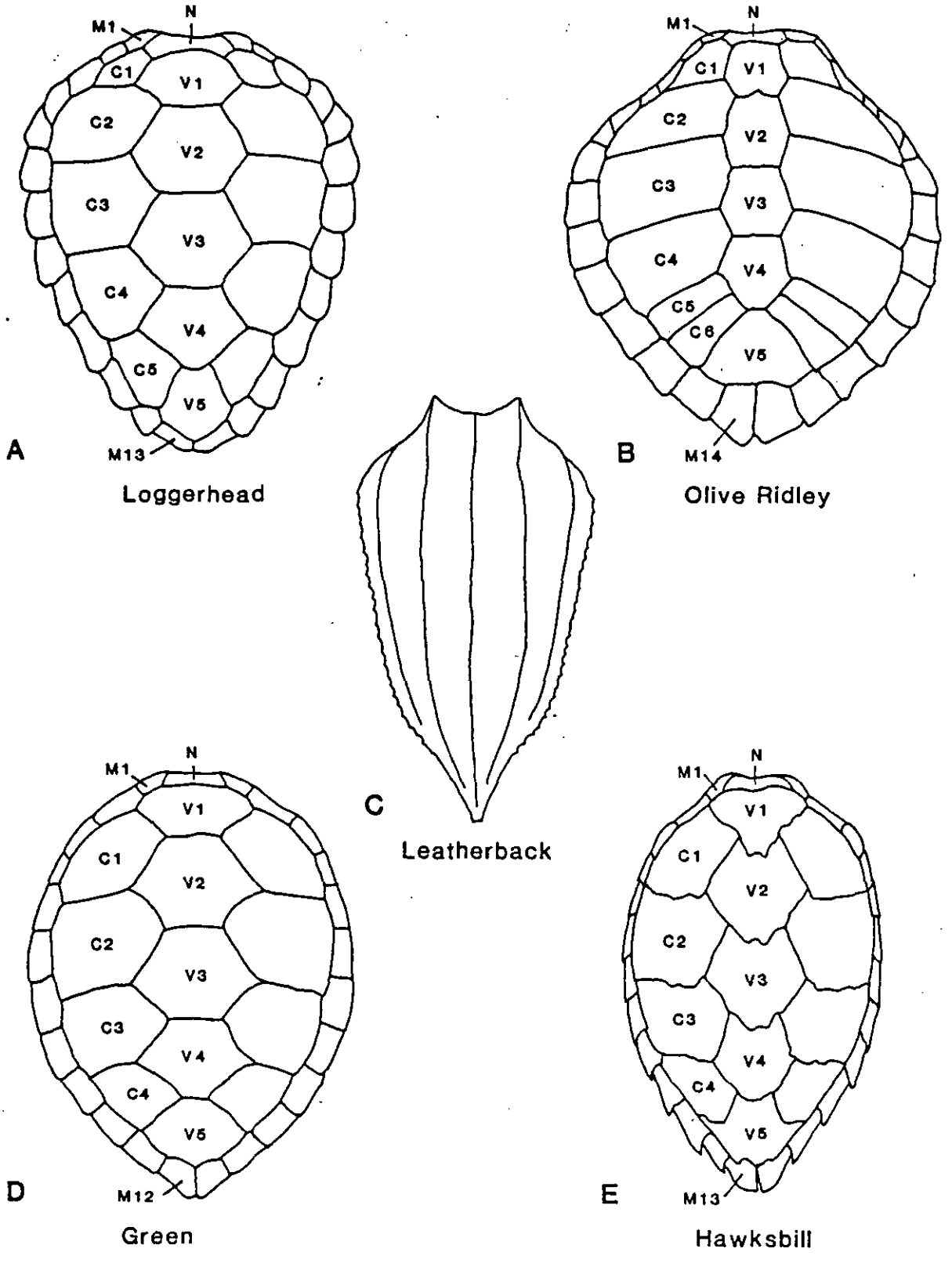


Figure 1. Sea turtle carapaces: V, vertebral scutes; C, costal scutes; M, marginal scutes; N, nuchal scute. (Not to scale).

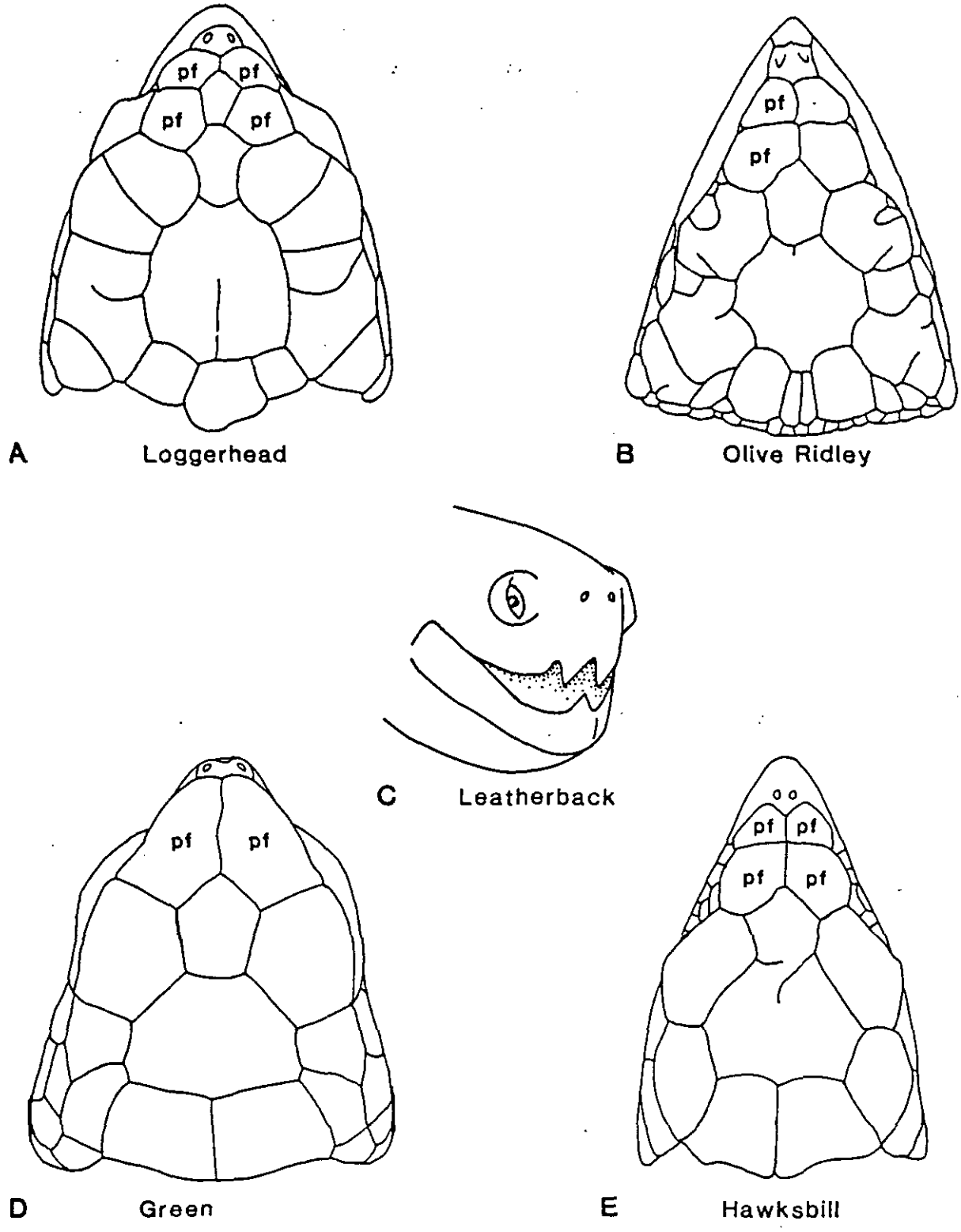


Figure 2. Sea turtle heads showing scales on dorsal surface. Olive Ridley, Loggerhead and Hawksbill all have at least 2 pairs of prefrontal scales; Green has 1 pair. Leatherback showing notched jaw. (Not to scale).

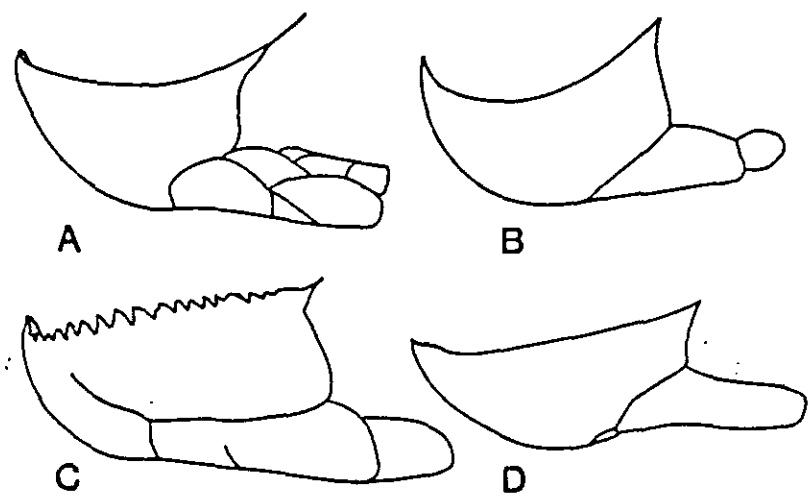


Figure 3. Lower jaw with horny sheath of A. Loggerhead; B. Olive Ridley; C. Green (note serrated edge); D. Hawksbill (sometimes mildly serrated).

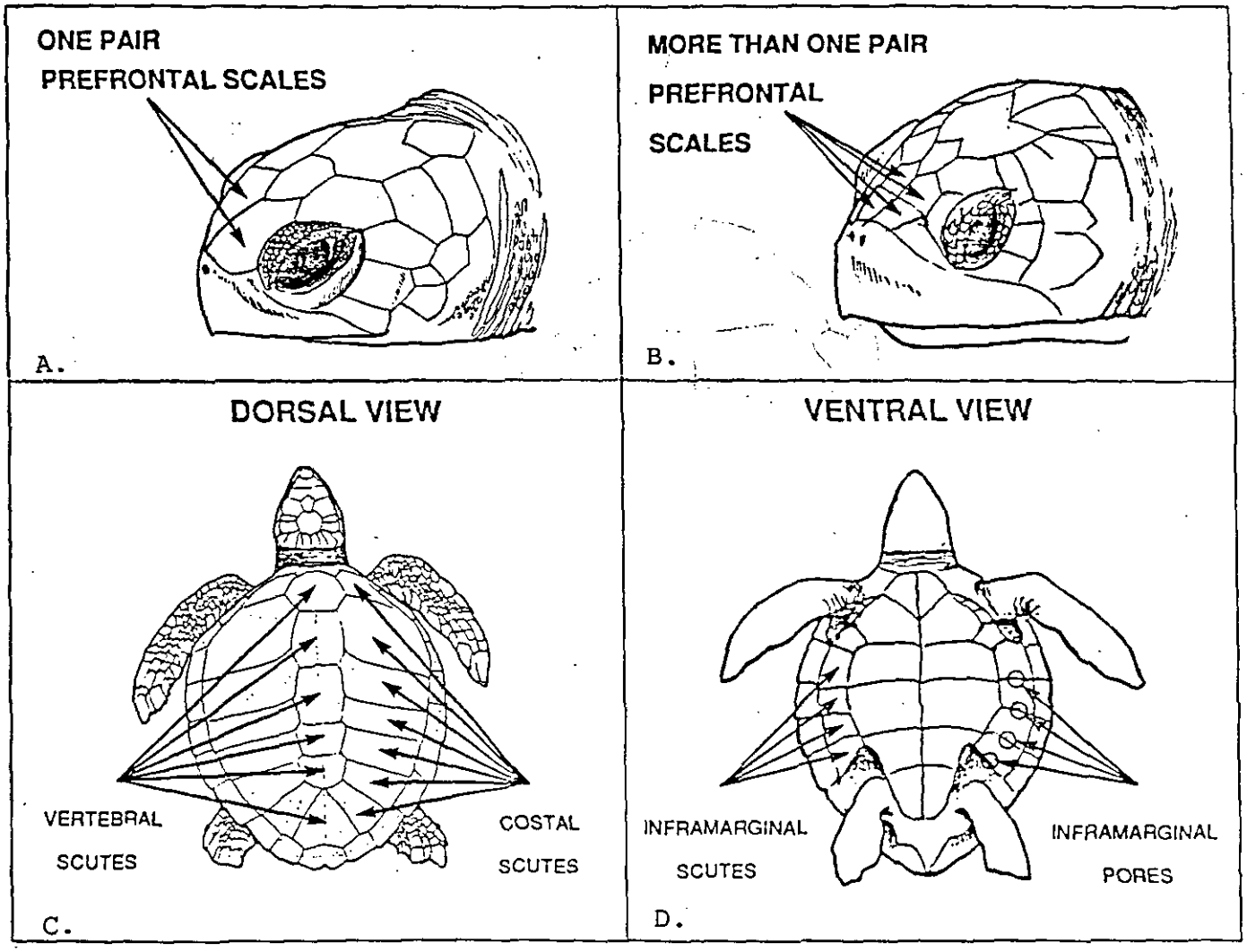


Figure 4. (A.) Green turtle head showing one pair of prefrontal scales. (B.) More than one pair of prefrontal scales occur on olive ridley, loggerhead, and hawksbill. (C.) Dorsal view of hardshell turtle showing location of major scutes. (D.) Ventral view of hardshell turtle showing location of inframarginal scutes and pores.

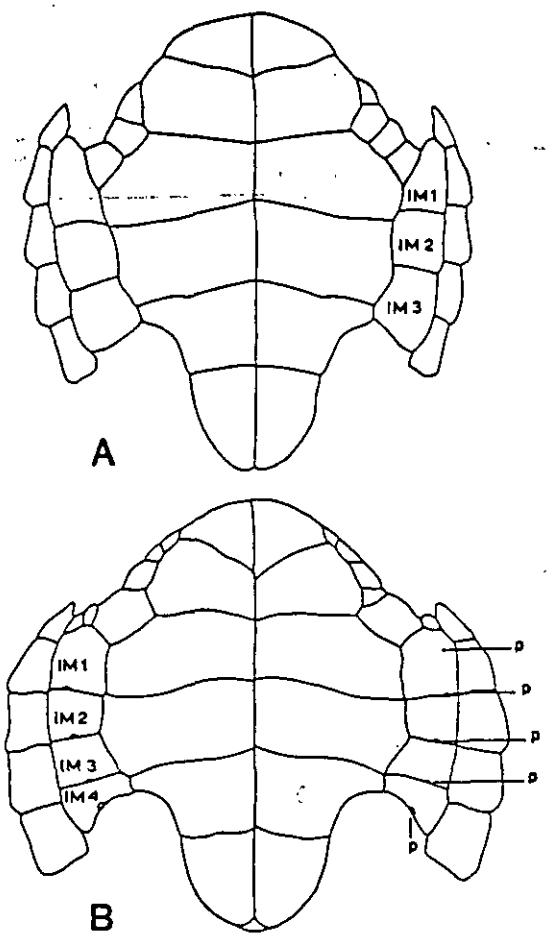


Figure 5. Plastron and inframarginals (IM) of A. Loggerhead and B. Olive Ridley; p = inframarginal pores.